This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

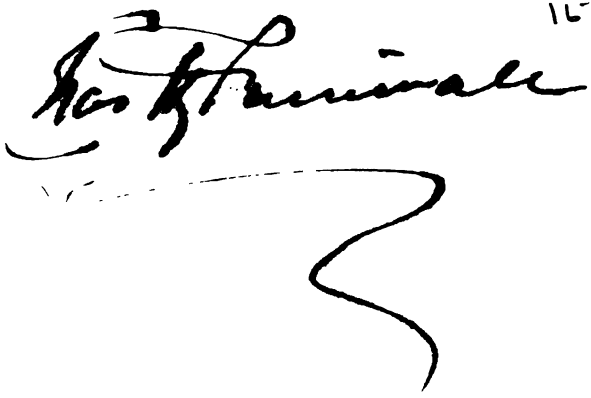
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

E. H. B.

16-118



TRANSACTIONS

OF THE

EPIDEMIOLOGICAL SOCIETY

OF

LONDON.

NEW SERIES. VOL. III.

SESSION 1883-84.

LONDON:
DAVID BOGUE, 27, KING WILLIAM STREET,
STRAND, W.C.

MDCCCLXXXIV.

All rights reserved.

BOSTON MEDICAL
DEC 26 1918
LIBRARY

CATALOGUED.
DEC 26 1918
M.E.C.

LONDON:
WHITING AND COMPANY, LIMITED, SARDINIA STREET, LINCOLN'S INN FIELDS.

CONTENTS.

Medico-Topographical and Health Histories for Districts and Towns. By Norman Chevers, C.I.E., M.D., President - - 1

Scurvy, in its bearings on Explorations by Sea. By Sir W. R. E. Smart, K.C.B., R.N., M.D. - - - - 14

The Origin of the Cholera Epidemic of 1883 in Egypt. By Sir W. Guyer Hunter, K.C.M.G., M.D. - - - - 43

The Etiology and Pathology of Cholera. By George Gulliver, M.A., M.B. - - - - - 65

The Behaviour of Certain Epidemic Diseases in Natives of Polynesia, with especial reference to the Fiji Islands. By Bolton G. Corney, Colonial Surgeon, Fiji - - - - 76

The Colonisation of the Sub-Himalayas and Neilgherries, with remarks on the Management of European Children in India. By Deputy-Surgeon-General Joseph Ewart, M.D. - - 96

Epidemiological Notes during the Autumn of 1883 in Beyrout, Syria. By John Wortabet, M.D. - - - - 118

Some Observations on the Etiology of Diphtheria. By H. Franklin Parsons, M.D. - - - - - - 124

The Re-vaccination of School Children. By R. D. R. Sweeting - 146

Notes on the Death-rate from Small-pox in the City of Chester in 1774. By Charles E. Paget - - - - 151

EPIDEMIOLOGICAL SOCIETY OF LONDON.

OFFICERS AND OTHER MEMBERS OF COUNCIL

FOR THE SESSION 1884-5.

President.

NORMAN CHEVERS, C.I.E., M.D.

Honorary Vice-Presidents.

EARL OF SHAFTESBURY, K.G.
LORD MOUNT-TEMPLE.
EDWIN CHADWICK, C.B.

Vice-Presidents.

GAVIN MILROY, M.D.
Sir WILLIAM JENNER, Bart., K.C.B., M.D., D.C.L., F.R.S., Physician in Ordinary to Her Majesty the Queen.
Sir HENRY W. ACLAND, K.C.B., M.D., F.R.S., Regius Professor of Medicine in the University of Oxford.
Sir JOHN WATT REID, K.C.B., M.D., Director-General Navy Medical Department.
Sir WILLIAM M. MUIR, K.C.B., M.D.
THOMAS CRAWFORD, M.D., Director-General Army Medical Department.
JOHN SIMON, C.B., D.C.L., F.R.S.
BENJAMIN W. RICHARDSON, M.D., F.R.S.
ROBERT LAWSON, Inspector-General of Hospitals, Royal Army (retired).
Sir WILLIAM R. E. SMART, K.C.B., K.L.H., M.D., R.N., Inspector-General of Fleets and Hospitals (retired).
JOHN MURRAY, M.D., Surgeon-General (retired).
Sir JOSEPH FAYRER, K.C.S.I., LL.D., M.D., F.R.S., Q.H.P.
GEORGE BUCHANAN, M.D., F.R.S.

Treasurer.

R. THORNE THORNE, M.B., 45, Inverness Terrace, W.

General Secretaries.

SHIRLEY F. MURPHY, 158, Camden Road, N.W.
CHARLES E. PAGET, Kendal, Westmorland.

Secretary for Navy.

WALTER DICKSON, M.D., R.N., Medical Officer to the Hon. Board of Customs, Custom House, E.C.

Secretary for Army.

ROBERT LAWSON, Inspector-General of Hospitals (retired).

Foreign and Colonial Secretaries.

Germany and Russia	ALEXANDER COLLIE, M.D.
Sweden, Norway, and Denmark ...	J. W. MOORE, M.D.
Portugal and the Brazils ...	J. J. L. DONNETT, M.D., R.N.
East Indies	JOHN MURRAY, M.D. J. B. SCRIVEN.
West Indies and South America ...	G. C. HENDERSON, M.D.
China and Australia	WILLIAM SQUIRE, M.D.
Indian Ocean and East Africa ...	J. CHRISTIE, M.D.
North America	JOSEPH EWART, M.D.

Other Members of Council.

T. SPENCER COBBOLD, M.D., F.R.S.
ROBERT CORY, M.D.
W. H. CORFIELD, M.D.
Brigade-Surg. W. G. DON, M.D.
G. F. FLEMING, F.R.C.V.S.
Surg.-Gen. C. A. GORDON, C.B., M.D., Q.H.P.
EDWIN HAWARD, M.D.
Sir A. D. HOME, K.C.B., V.C., M.D.
Sir W. GUYER HUNTER, K.C.M.G., M.D.
JOHN MCCOMBIE, M.D.
J. BURDON SANDERSON, M.D., F.R.S.
HERMANN WEBER, M.D.

LIST OF MEMBERS.*

(P) *President;* (T) *Treasurer;* (S) *Secretary.*

HONORARY MEMBERS.

Elected.
1867. Acland, Sir Henry W., K.C.B., M.D., F.R.S., Oxford.
1868. Guipon, D. J., Laon Aisne, France.
1878. Muir, Sir William M., K.C.B., M.D.
1852. Richardson, B. W., M.D., F.R.S., 25, Manchester Square, W.
1850. Simon, John, C.B., D.C.L., F.R.S., 40, Kensington Square, W.
1883. Sonsino, Prospero, M.D., Cairo.
1863. Stark, Jas., M.D., Huntfield, Biggar, Lanarkshire.

ORDINARY MEMBERS.

1878. Airy, Hubert, M.D., Local Government Board, Whitehall, S.W.
1882. Armstrong, Henry E., 6, Wentworth Place, Newcastle-on-Tyne.
1884. Atkinson, F. E., Settle, Yorkshire.
1881. Axe, J. Wortley, F.R.C.V.S., Veterinary College, Camden Town, N.W.
1882. Barry, F. W., M.D., Local Government Board, Whitehall, S.W.
1883. Bovill, Edward, M.B., C.M., Surgeon Ind. Med. Dept., Messrs. H. S. King and Co., 45, Pall Mall, S.W.
1870. Buchanan, George, M.D., F.R.S., 24, Nottingham Place, W. (P. 1881-83. T. 1871-81.)

---

* Members are requested to inform the Secretaries of any corrections when necessary.

Elected.

1882. Carpenter, Alfred, M.D., Duppas House, Croydon.
1876. Chevers, Norman, C.I.E., M.D., President, 32, Tavistock Road, Westbourne Park, W. (President from 1883.)
1882. Cobbold, T. Spencer, M.D., F.R.S., 74, Portsdown Road, Maida Vale, W.
1868. Cock, Fred., M.D., 1, Westbourne Park Terrace, W.
1875. Collie, Alexander, M.D., Eastern District Hospital, Homerton, E.
1884. Comyn, J. I., Dep. Surg.-Gen., 32, Dawson Place, W.
1871. Corfield, W. H., M.D., 10, Bolton Row, Mayfair, W. (S. 1871-72).
1879. Cory, Robert, M.D., 73, Lambeth Palace Road, S.E.
1863. Crawford, Thomas, M.D., Director-General Army Med. Dept., 6, Whitehall Yard, S.W.
1884. Cullimore, D. H., M.D., 27, Welbeck Street, W.
1863. Dickson, Walter, M.D., R.N., Fairfield, Belvedere Road, Upper Norwood.
1880. Don, W. G., M.D., Brigade-Surgeon Army Med. Dept., 6, Whitehall Yard, S.W.
1883. De Renzy, A. C. C., C.B., Surg.-Gen. Ind. Med. Dept. (*Retired*), 9, Sydenham Villas, Bray, Co. Wicklow, Ireland.
1871. Dyke, Thomas Jones, Merthyr Tydvil, South Wales.
1879. Ewart, Joseph, M.D., Dep. Surg.-Gen. Ind. Med. Dept. (*Retired*), Montpelier Hall, Brighton.
1884. Faulkner, Alex., Surg., Messrs. Grindley & Co., 55, Parliament Street, S.W.
1875. Fayrer, Sir Joseph, K.C.S.I., M.D., LL.D., F.R.S., Surg.-Gen. Ind. Med. Dept. (*Retired*), 53, Wimpole Street, W. (P. 1879-81.)
1882. Fleming, G. F., F.R.C.V.S., Cathcart Lodge, Tyrwhitt Road, St. John's, S.E.
1883. Furnivall, C. H., Lynton Road, Acton, Middlesex.
1880. Gordon, C. A., C.B., M.D., Q.H.P., Surg.-Gen., 25, Westbourne Square, W.
1884. Hanbury, Sir James, K.C.B., Surg.-Gen., 17, Vanbrugh Park, Blackheath, S.E.
1875. Hare, C. J., M.D., Berkeley House, 15, Manchester Square, W.
1884. Harris, F. W. H. D., 8, High Lever Road, Kensington, W.
1860. Haward, Edwin, M.D., 9, Harley Street, W.
1882. Hobley, S. Halford, 49, Bellevue Road, Southampton.
1879. Hood, Donald, M.D., 43, Green Street, Mayfair, W.
1883. Hopwood, E. O., M.D., London Fever Hospital, Islington, N.
1880. Hunter, Sir W. Guyer, K.C.M.G., M.D., Surg.-Gen. Ind. Med. Dept., 21, Norfolk Crescent, W.
1863. Jenner, Sir William, Bart., K.C.B., M.D., F.R.S., 63, Brook Street, W. (P. 1866-68.)
1884. Johnston, W., Surg.-Major Army Med. Dept., 6, Whitehall Yard, S.W.
1878. Johnston, William, M.D., 2, Melbourne Street, Leicester.
1881. Kennett, V. B. Barrington, 15, Hyde Park Gardens, W.
1883. Kirker, Gilbert, R N., M.D., Surg. R. N. Hospital, Gosport.
1881. Kynsey, W. R., 5, Waterloo Crescent, Guildford, Surrey.
1863. Lawson, Robert, Inspector-Gen., 20, Lansdowne Road, Notting Hill, W. (P. 1871-73.)
1884. Ligertwood, Thomas, M.D., Dep. Surg.-Gen., Royal Hospital, Chelsea, S.W.
1880. Longstaff, G. B., M.B., Southfield Grange, West Hill Road, Wandsworth, S.W.

Elected.

1882. Manifold, M. F., Surg.-Gen., 42, Cathcart Road, South Kensington, S.W.
1878. McCombie, John, M.D., South-Eastern District Hospital, Deptford, S.E.
1880. McKellar, A. Oberlin, St. Thomas's Hospital, S.E.
1883. Merriman, J. W. C., 42, Kensington Square, W.
1850. Milroy, Gavin, M.D., 21, Church Road, Richmond, Surrey. (P. 1864-66. S. 1862-64.)
1883. Moore, Sandford, M.B., Surg.-Major, Army Med. Dept., Netley.
1884. Moore, W. J., C.I.E., Surg.-Gen. East India United Service Club, St. James's, S.W.
1872. Murray, John, M.D., Surg.-Gen. Ind. Med. Dept. (*Retired*), 17, Westbourne Square, W. (P. 1877-79.)
1875. Murphy, Shirley Forster, Hon. Secretary, 158, Camden Road, N.W. (S. from 1877.)
1883. Nash, W., M.B., Surg.-Major Army Med. Dept., 6, Whitehall Yard, S.W.
1883. Paget, Charles E., Hon. Secretary, Kendal, Westmorland. (S. from 1883.)
1858. Paine, H. J., M.D., Elmsfield, Newport Road, Cardiff, South Wales.
1884. Parkes, Louis, M.D., 51, Cadogan Square, S.W.
1883. Parsons, H. Franklin, M.D., Local Government Board, Whitehall.
1880. Payne, J. F., M.D., 78, Wimpole Street, W.
1884. Pringle, R., Surg.-Major, 2, Aberdeen Terrace, Blackheath, S.E.
1879. Ransom, W. H., M.D., F.R.S., Nottingham.
1884. Ray, George, Surg.-Gen., 76, Jermyn Street, S.W.
1880. Reid, Sir John Watt, K.C.B., M.D., Director-General Navy Med. Dept., Admiralty, 44, Spring Gardens, S.W.
1875. Reynolds, J. Russell, M.D., F.R.S., 38, Grosvenor Street, W.
1875. Roberts, F. T., M.D., 53, Harley Street, W.
1884. Roe, E. A. H., Surg.-Major Army Med. Dept, 6, Whitehall Yard, S.W.
1873. Saunders, C. E., M.D., 21, Lower Seymour Street, W.
1882. Scriven, J. B, Brigade-Surgeon Ind. Med. Dept., 95, Oxford Gardens, Notting Hill, W.
1873. Seaton, E. C., M.D., 35, George Street, Hanover Square, W.
1857. Smart, Sir William R. E., K.C.B., M.D., Inspec.-Gen., 21, Castletown Road, West Kensington, S.W. (P. 1873-75.)
1878. Smee, A. H., The Grange, Hackbridge, Surrey.
1879. Smith, W. Tonge, M.D., 129, Ladbroke Grove, W.
1882. Smith, W. R., M.D., F.R.S.E., Bayshill Villa, Cheltenham.
1880. Spear, John, Local Government Board, Whitehall, S.W.
1872. Squire, William, M.D., 6, Orchard Street, W. (S. 1873-77.)
1878. Stevenson, Thomas, M.D., Sandhurst Lodge, Gresham Road, Brixton, S.W.
1880. Sweeting, Richard, South-Western District Hospital, Fulham, S.W.
1871. Thorne, R. Thorne, M.B., Treasurer, 45, Inverness Terrace, W. (T. from 1881. S. 1879-81.)
1876. Turner, George, High Street, Hoddesden, Herts.
1854. Weber, Hermann, M.D., 10, Grosvenor Street, W.
1882. Whitelegge, B. A., M.D., Nottingham.
1883. Willoughby, Edward F., M.D., Bratton Lodge, Green Lanes, N.
1883. Young, Keith Downes, A.R.I.B.A., 17, Southampton Street, Bloomsbury, W.C.

CORRESPONDING AND NON-RESIDENT MEMBERS.

Elected.

N.R. 1867. Allbutt, T. Clifford, M.D., Park Chambers, Leeds.
C. 1875. Arkhangelsky, D., M.D., St. Petersburg, Russia.
N.R. 1875. Armistead, William, M.B., Great Shelford, Cambridge.
C. 1852. Barker, R. H., Hungerford, Berks.
C. 1852. Bartolomé, Mariano Martin de, 3, Eyre Street, Sheffield.
C. 1856. Barton, E. H., New Orleans, U.S.A.
C. 1853. Beneke, F. W., Marburg, Germany.
C. 1860. Brionde, A. de, Haute Loire, France.
N.R. 1864. Buckle, Fleetwood, M.D.
N.R. 1866. Caddy, J. T., M.D., Fleet-Surg., 82, Redcliffe Square, S.W.
N.R. 1881. Carter, H. Vandyke, M.D., Surg.-Major Ind. Med. Dept.
C. 1851. Cartledge, Benjamin, Vet. Surg., Sheffield.
N.R. 1883. Castor, G. F., M.B., Colonial Surgeon, Cape Coast Castle, West Coast of Africa.
C. 1871. Christie, James, M.D., Zanzibar.
N.R. 1873. Close, C. Stratherne, Surgeon-Major Army Med. Dept.
N.R. 1875. Coffin, R. J. M., Alwington House, Baron's Court, West Kensington, S.W.
C. 1875. Colvill, W. H., Surg.-Major, Bagdad.
N.R. 1880. Condon, J. H., Surg.-Major Ind. Med. Dept., Cawnpore, N.W.P. India.
C. 1851. Cooke, R. T. E. B., Scarborough.
C. 1856. Cox, Wm. Isidore, Hawkesbury, Upton, Chipping-Sodbury, Gloucestershire.
C. 1871. Cuningham, J. M., M.D., Surg.-Gen. Ind. Med. Dept., Sanitary Commissioner of Govt. of India.
C. 1860. Curtis, Josiah, Boston, U.S.A.
N.R. 1876. Day, E. J., Dorchester.
C. 1878. Delmas, Louis H., M.D., P.O. Box 524, Havana, Cuba.
C. 1853. Dempster, Charles Carroll, M.D., Dep. Insp.-Gen. (*Retired*).
N.R. 1852. Dickinson, Wm. Lindow (address unknown)
C. 1867. Dickson, E. Dalziel, M.D., Physician to British Embassy, Constantinople.
N.R. 1871. Domenichetti, Richard, M.D., Trinity Lodge, Louth, Lincoln.
N.R. 1864. Donnett, J. J. L., M.D., R.N., 10, Pencester Road, Dover.
N.R. 1863. Ducket, C. A., M.D., 12, St. George's Terrace, Great Yarmouth
N.R. 1871. Dunlop, James, M.D., 18, Carlton Place, Glasgow, N.B.
N.R. 1882. Fasken, William A. D., M.D., Surg. Ind. Med. Dept., Messrs. Grindlay and Co., 55, Parliament Street, S.W.
N.R. 1875. Fox, J. Makinson, M.D., The Grove, Lymm, Cheshire.
N.R. 1883. Fraser, Manson D., M.D., British North Borneo, Oceania.
N R. 1883. Furnell, M. C., M.D., Surg.-Gen., Shearman's Gardens, Madras.
C. 1851. Galland, —, M.D., Malta.
C. 1863. Hall, E. Swarbreck, 58, Campbell Street, Hobart Town, Tasmania.
N.R. 1852. Hardwicke, Junius, Clifton Lodge, Rotherham.
N.R. 1876. Hardwicke, H. Junius, M.D., Burton Lodge, Wostenholm Road, Sheffield.
N.R. 1872. Harris, Henry, M.D., Trengweath Place, Redruth, Cornwall.

Elected.

C. 1852. Harrison, J. B., M.D., Higher Broughton, Manchester.
N.R. 1880. Harrison, R. Charlton, M.D., St. Mary's Vale, Chatham, Kent.
N.R. 1855. Haviland, Alfred.
C. 1852. Hebra, Ferdinand, M.D., Vienna.
N.R. 1881. Henderson, G. C., M.D., Kingston, Jamaica.
N.R. 1882. Herring, John F., Builth, South Wales.
N.R. 1875. Hime, T. W., M.D., Bradford, Yorkshire.
C. 1853. Hirsch, August, M.D., Berlin.
N.R. 1871. Hogg, F. R., M.D., R.H.A.
N.R. 1875. Home, Sir Anthony D., K.C.B., V.C., M.D., Surg.-Gen. India.
N.R. 1866. Home, A. H., M.D., Hullerhirst, Steventon, Ayrshire.
C. 1851. Hoskins, S. E., Guernsey.
N.R. 1881. Irwin, Chamney Graves, M.D., Dep.-Surg.-Gen., Bermuda.
N.R. 1855. Jacobson, T. E., Sleaford, Lincolnshire.
C. 1851. Kellay, —, M.D., Beyrout, Syria.
C. 1857. Leas, Jose Fernandes da Silva, Cape de Verde.
C. 1875. Lent, M.D., Cologne.
N.R. 1879. Lilburne, James, M.D., Dep. Inspec.-Gen., Duncrivie House, Milnathort, N.B.
C. 1851. Litt, W., Veterinary Surgeon, Shrewsbury, Salop.
N.R. 1873. Little, James, M.D., 14, Stephen's Green, North Dublin.
C. 1857. Lowtzoff, —, St. Petersburg, Russia.
N.R. 1881. Lyons, R. T., M.D., Surgeon-Major, Rampart Barracks, Fort William, Calcutta.
C. 1870. Mallet, —, M.D., Warsaw.
N.R. 1865. Mapother, E. D., M.D., 6, Merrion Square North, Dublin.
N.R. 1867. Marshall, John, 13, Liverpool Street, Dover.
N.R. 1860. May, George, jun., Reading, Berks.
C. 1854. Moffatt, Thomas, M.D. (address unknown).
N.R. 1872. Moore, John Wm., M.D., 40, Fitzwilliam Square West, Dublin.
C. 1851. Monzon, Rafael, Barbacaos, New Grenada.
C. 1853. Neumann, —, M.D., Berlin.
C. 1851. Noble, Daniel, M.D., 258, Oxford Road, Manchester.
N.R. 1881. Oldham, Chas., Surg.-Major Ind. Med. Dept., Shurdington Road, Cheltenham.
N.R. 1883. Page, W. Bousfield, St. Ann's, Carlisle.
C. 1872. Poggio, Don Ramon Hernandez, Cuba.
C. 1854. Purple, S. S., M.D., New York, U.S.A.
N.R. 1875. Ransome, Arthur, M.D., F.R.S., Devisdale, Bowdon, Cheshire.
N.R. 1874. Reid, Walter, M.D., Staff-Surgeon, Royal Naval Hospital, Haslar.
N.R. 1866. Robertson, James, M.D., Alfred Place, Melbourne.
N.R. 1863. Rowe, T. Smith, M.D., Cecil Street, Margate.
N.R. 1879. Ross, J. T. C., C.I.E., Surgeon-General Ind. Med. Dept., The Grove, Ryde, Isle of Wight.
N.R. 1881. Russell, E. G., M.B., B.Sc., Surg. Ind. Med. Dept., Gauhàti, Assam, India.
N.R. 1875. Russell, J. B., M.D., 1, Montrose Street, Glasgow.
N.R. 1859. Sanderson, J. Burdon, M.D., F.R.S., 50, Banbury Road, Oxford.
C. 1851. Sankey, F. F., Malta.
C. 1879. Sarrell, Richard, M.D., Constantinople.
C. 1873. Schleisner, —, M.D., Copenhagen.

Elected.

C. 1874. Schlimmel, M.D., Teheran.
C. 1852. Schürmayer, Professor, Heidelberg, Germany.
N.R. 1858. Scratchly, G., New Orleans, U.S.A.
C. 1851. Sharpe, Richard, Beverley Road, Hull.
N.R. 1869. Shaw, James, Insp.-Gen. (address not known).
C. 1853. Sigmund, C. L., Vienna.
N.R. 1867. Smith, R. Wagstaff, Mount Rundell, Harborne, Birmingham.
N.R. 1854. Spinks, C. N., Sankey Street, Warrington.
C. 1851. Spooner, W. C., Vet. Surg., Southampton.
C. 1876. Sternberg, Geo. M., M.D., United States Army, Port Point San Jose, San Francisco, California.
N.R. 1880. Tatham, John, M.D., Town Hall, Salford, Manchester.
C. 1860. Taylor, H. Sharp, 15, Quarry Street, Guildford.
C. 1855. Tholozan, J. Désiré, M.D., Teheran.
N.R. 1853. Todd, J. George, Evenwood, West Auckland, Durham.
N.R. 1873. Townsend, Stephen Chapman, C.B., Surg.-Gen. Ind. Med. Dept., Sanitary Commissioner for Central India.
C. 1851. Tribes, E., Nismes, France.
C. 1855. Tribuchet, Adolphe, Paris.
C. 1853. Valerj, —, M.D., Rome.
C. 1852. Varentrapp, George, M.D., Frankfort.
C. 1855. Virchow, Rudolf, Professor, 10, Schellings Strasse, Berlin.
C. 1856. Von Iffland, —, Beaufort, New Quebec.
N.R. 1879. Watson, Alexander, M.D., R.N., Dep. Insp.-Gen., Army and Navy Club.
C. 1853. Watson, John, M.D., Jamaica.
N.R. 1880. Whishaw, J. C., M.D., Surg.-Major Ind. Med. Dept., Lucknow.
N.R. 1880. White, J. Berry, M.D., Surg.-Major Ind. Med. Dept., St. Andrew's House, Hertford, Herts (*retired*).
C. 1861. Whitelaw, Wm., M.D., Kirkintilloch, Dumbartonshire.
N.R. 1854. Wiblin, John, Southampton.
N.R. 1865. Williams, C., 9, Prince of Wales's Road, Norwich.
N.R. 1872. Woodall, John (address not known).
N.R. 1875. Wortabet, John, M.D., St. John's Hospital, Beyrout.

IN MEDIC...
DEC 26 1918
TRANSACTIONS
LIBRARY

Epidemiological Society of London.

MEDICO-TOPOGRAPHICAL AND HEALTH HISTORIES FOR DISTRICTS AND TOWNS.

By NORMAN CHEVERS, C.I.E., M.D., President.

Inaugural Address of Session 1883-84.

(*November 7th*, 1883.)

Gentlemen,—In occupying the position to which you have elected me, I have first to perform the pleasant duty of expressing my warm sense of the great honour which you have conferred upon me in desiring that I should preside at our meetings during the coming year. I feel the value of this distinction to be validly enhanced by the fact that, in placing me here, you pay a compliment and offer a strong encouragement to the medical officers of the Indian Army who, when toiling during a working lifetime in a country absolutely remote from the scientific associations of their civil medical brethren, cannot but feel gladdened by the knowledge that, on their retirement, they will be welcomed in a spirit of large hospitality and courtesy by the greatest medical philosophers of their time.

Since our last annual meeting, the scientific world and this Society have sustained a loss, which must long be deeply felt, in the death of William Farr, a past President and a Vice-President of our Association. I dislike much those eulogies which the little living are wont to offer glibly to the memory of the great dead. I will not, therefore, presume to record one syllable of praise upon the tomb of the esteemed and honoured brother who has passed from amongst us. I will only ask a plain question, which will find a reply in all our minds. In what position would our knowledge of vital statistics and of sanitation have now stood if England had not given birth to William Farr, whom she has lost, and to Edwin Chadwick, whom she still possesses?

The high object of the Epidemiological Society is, under the blessing of Divine Providence, to find means of protecting

mankind against "the Pestilence that walketh in darkness", an inspired expression by which we may be permitted to understand, not literally that pestilence which, like cholera, notoriously steals upon its victims at the dead of night, but those pestilential maladies which are so dark in their manifestations that, even up to the present moment, our best men of science give them directly opposed interpretations.

When I had the privilege, a few years ago, of beginning to take an active part in the business of this Society, I had in my mind a painful recollection of the fact that, in my youth, the way of physicians who sought to discover the law of pestilence lay in absolute darkness beneath that lurid cloud of *odium theologicum* with which the bitterly controversial spirit of the seekers enveloped the object of their quest; and I feared that a spark of that feeling might linger here. But I soon found that, although every member of this body holds very strong opinions, these convictions are maintained in a spirit of the broadest and most philosophic tolerance. In this place the contagionist meets the non-contagionist, not as an irreconcilable foe, or even as an erring brother, but as a valued fellow-worker, the fruits of whose labour are shared and prized alike by every member of our community. For my own part, much as I value those epidemiologists who think as I do, I am not sure that, if they were the sole occupants of these chairs, I should come here to meet them. I could do that equally well at a club or at the Pathological. Loving, for its own precious sake, that knowledge which I trust will not be withdrawn from me in the place to which I am hastening, I come here to collect gratefully, from friends who do not think precisely as I do, facts and opinions by which my own scanty information and narrow views may be corrected and widened. In this spirit, I believe, we all work. Still, on the present occasion, I have chosen for this address a subject which, in its scientific aspects, is scarcely open to controversy, in favour of which I hope to enlist the sympathy and co-operation of men of all opinions. I have long been desirous to re-submit to your judgment the by no means novel suggestion that medico-topographical and health histories for districts and towns, the publication of which was successfully conducted by the Government of India, would validly aid the great work of public health which has long been in progress throughout the British Isles. I may probably be met here by the objection—the fact that, even within the term of your own Indian Service, no such publications were issued by the Government of India, is evidence that this undertaking proved a failure,

and was therefore abandoned. To this assertion my reply would be—in India, as at home, the discontinuance of a great work is by no means valid evidence of its failure. There, as here, Governments change at brief intervals, and new men bring new measures. There, too, it frequently happens that whatever was right in the government of A is wrong under the rule of his successor B. Works like the three bulky volumes on the *Medical Topography and Statistics of the Madras Presidency*, which I now place before you, stand as enduring monuments of the practicability of such a measure, and as evidence of its successful working.

Upon a plan suggested by the late Sir Ranald Martin, the Government of India directed, in 1835, that medico-topographical histories of districts and military and civil stations throughout British India should be prepared by medical men and published. The result was the promulgation of many hundred very useful pages, a few of which have escaped until now the ravages of the white ants. Among these histories, that in three closely printed volumes, which now lie before me, stands pre-eminent. Between 1842 and 1844 the Medical Board of Madras published this complete history of the medical topography and statistics of the whole of the Madras Presidency, founded upon reports by local medical officers. The vast labour of compilation was accomplished in three years by the Board's Secretary, Dr. George Pearse, most efficiently aided by Dr. Lorimer, garrison-surgeon of Fort St. George—each of these officers performing at the same time the proper duties of his own appointment. I particularly insist upon this fact as evidence that, upon a well-arranged plan and with the aid of a very few well-chosen men, the great, but in no way formidable, work of preparing a health-history for every district and town in the United Kingdom might be carried out at no very heavy cost, and with an expedition commensurate with the strength of the officers employed.

The Presidency of Madras alone succeeded in fully giving effect to the wishes of Government; but much good work in this direction was done by the separate action of medical officers in the other two Presidencies. Thus, we have exceedingly valuable reports on the medical topography of Calcutta, by Ranald Martin, Duncan Stewart, and Pemble Strong; of Upper Scinde, by Kinloch Kirk and J. Sutherland; of Meerut, by John Murray, who, happily, is now a leading worker among ourselves; on Ajmere, by Irvine; on Oudh, by Donald Butter; on Sarun, by Rankine; on the Valley of the Indus, by Percival Lord; on Assam, by

McCosh; on Kemaon, by Dollard and John McClelland. Still, as I have said, the Bengal and Bombay series were never completed. A large number of valuable minor topographical reports of districts and stations in each Presidency, such as those published in the *Bombay Medical and Physical Transactions* for 1857-58, have appeared during the last forty years in Indian medical periodicals.

Here I may remark that, old as the whole of these reports are, they are replete with facts and observations which, like every sterling truth in medicine, are of never-dying value. I have lately gone carefully through a very large proportion of these records, which I never had opportunity of doing in India; and I deeply feel that the result of this pleasant exercise is that I now, for the first time, believe that I have been enabled to take a large view of Indian disease, especially of its geographical disposition.

Merely as evidence that the undertaking which I am now proposing is by no means so gigantic or so costly as to be hopeless, I may mention that, in my work on the *Means of Preserving the Health of European Soldiers in India*, I have left a sketch of the health-history of every station for European troops in that dependency, this being a mere labour of love carried out in the spare moments of an official life which had no proper leisure. As a proof that I do not mention this little fact in a boastful spirit, and as a hint of the encouragement which labourers in this field may anticipate from authority, I may mention the criticism which my labours received from the Viceroy of that day. Inquiring of a medical officer regarding some statistical point, his Lordship was asked, "Have you seen Dr. Chevers's work?" The reply was, "Humph!"—with a significant upraising of the chin.

I need scarcely say that—quite apart from those pseudo-medical histories in which, during last century, were trumpeted the sanitary advantages of every English nook which, by virtue of the addition of a wheelbarrowful of rusty iron to a brackish pool, had become a "spa"—the United Kingdom can boast of some excellent medical topographies. Still, these are chiefly the work of local ability and industry, and they by no means defend us Britons from the charge that we are far behind India in the work of medical topography. The proposal which I offer to your better judgment is, that for each of our districts and towns there should be prepared a concise but very comprehensive manual, illustrated by maps, in which would be recorded all needful geological and meteorological data; brief descriptions of the water-supply and systems of town and land drainage; a history of all re-

ported epidemics, endemics, and epizootics, the dates of the first appearance and of the disappearance of the recent ones being accurately given; all that is worthy of recollection as illustrating vital statistics, especially recent death-rates; full health-histories covering the last five years; numerical lists of the prevailing diseases, with brief but clear accounts of those which point to the fact that the land is malarious, or the town air impure. In short, these little works should comprise every fact which tends to illustrate the medical topography of their localities. The maps should especially define with rigid accuracy the locality and original extent of all extant or reclaimed lakes, marshes, harbours, bays, estuaries, water-courses, and moats. The sooner maps of this kind are prepared, the better. The work of so-called "improvement" now advances so rapidly, and the information derivable from oral tradition is so uncertain and short-lived, that all authentic facts of this kind should be placed on record with the least possible delay.

Four hundred years ago, an encircling morass was in some respects useful to a town, forming, as it did, a considerable addition to its defences, and a means for retreat, supply, and relief. In time of peace, the marsh afforded valuable supplies of rushes, reeds, fish, and water-fowl. So we find Henry of Huntingdon giving to his native town a recommendation which would scarcely be held attractive in these times of sanitation. The town, he says, "surpassed all others in pleasantness, in the beauty of the buildings, *nearness to the fens*, and plenty of game and fish".

In the middle ages, a well-preserved fen was a valuable property. It is noticed by Whitaker that, from an inquisition taken in the time of the last Earl Warren, it appears that the meadow ground which lay in open field was worth five shillings an acre; the pasture-ground was enclosed, and worth only one-tenth of that sum; and the fishery, a small pond of four acres, was worth almost one-third more per acre than the best meadow ground. Writing in 1650, Fuller mentions that "an acre of reeds on the bankside is as beneficial as one of wheat". In Surrey, I have sat and read by the feeble light of a peeled rush dipped in grease, held in a simple apparatus which is represented in Chambers' *Book of Days*. Formerly the richest pasture land near London was in the Isle of Dogs.

Our ancestors were evidently proud of their swamps, and were not ashamed to give districts and towns their right names, such as Romney Marsh, Slough, Burmarsh, Wapping-on-the-Wose, Keyingham Marsh in Holderness, Lambeth

Marsh, and the like. Now, however, our "jerry builders" are more discreet. Having, by some subtle arrangement with Nature, provided that the whole of their building sites shall possess an inexhaustible dry gravel soil, they construct infinite Montpelier Avenues, Mount Pleasant Gardens, and Vales of Health.

Since I returned from swampy Bengal, I have occasionally walked in some of these delightful modern sanitaria, and have been astonished at observing the manner in which, within my own recollection, modern enterprise has "improved" beyond all recognition, sites which our predecessors deemed utterly waste and irreclaimable. I may, without offence, mention one or two of these instances. Very lately I was admiring the architectural beauties of a popular city suburb, when a voice said gruffly, "A few years ago you couldn't go across that *plaice* without leaving both your shoes!" Some years since, I, for my sins, found myself enjoying a round of watering-place delights in a beautiful seaside resort, which completely covers and conceals all the little ineligibilities of what, in my boyhood, was a dreary expanse of salt swamp, whereon it was evidently hopeless to grow cabbages, and which has now lost its honest eight-hundred-years-old English name of the "Abbey Marsh". This recalls to my memory "Pump's Marsh", which, now a most attractive watering-place, was in my youth an admirable field for lizard-hunting—its greatest drawback being that, for those tired with that noble sport, there was nothing to drink, the whole of the streams which guttered slowly out of its sedgy pools having the appearance, but none of the virtues, of the strongest black tea. Still again, I recollect the site of that long most popular and fashionable watering-place, Sweet-Spring-by-the-Sea, when it was an utterly abandoned marsh devoid of any living thing standing higher in creation than the water-rat and the yellow flag.

Each of these manuals should receive, annually, an appendix containing a brief but comprehensive health-history of the place, and giving all needful particulars regarding outbreaks of disease, fluctuation in the death-rate, sanitary improvements, and the like.

But for your courtesy, you would perhaps stop me here, and say, "Your plan is impracticable! It would please no one!" But nearly all of those whom I address have long since felt, and acted upon the conviction that, in endeavouring to benefit mankind, we must not hope to please them. I apprehend that, in recommending to town authorities the adoption of this plan, which directly tends to serve the best

interest of every member of the community, we shall find the whole of our auditors, from Mister Mayor to Master Cobbler, as stony-faced and as unappreciative as William the Conqueror and Wat Tyler would have been. Nay more, we must expect to be shouted down with cries of "What! suffer the publication of a book giving a bad name to our town, and pay for the printing!" "Your plan will raise our rates and impair the value of everybody's property and business, depriving us of tenants and customers. You appear to wish to bring us all to ruin, and to reduce this place to the marsh which it was when our fathers occupied it fifty years ago!"

It does not seem very long since I sat at a meeting of a city municipality, and heard the following observations by a really very fine and clever old man: "This place has done very well for a hundred and fifty years without sanitation. I therefore propose, Mr. Chairman, that we resolve to defer the question of appointing a sanitary establishment for another hundred and fifty years, when it may be again considered." Here we have enunciated, in an unusually plain and candid manner, the feeling which still prevails in hundreds of aldermanic minds. I lately saw this old gentleman's statue, subscribed for by his admiring fellow-citizens,—it was a fine work of art. Every practical sanitarian is, however, proof against the blatant shallow-minded logic of short-sighted boors; but there is another obstacle which might possibly meet us, but which ought not to be formidable, because, assuredly, no one would intentionally place it in our way. Although I believe that no representative of our noble profession displays its humane philosophy with more enlightenment and self-devotion than the officer of health does, it has, in rare instances, appeared to me, when studying some of their reports, that a very little of the obstructive burgher narrowness has insensibly found its way into the minds of a few of these officials, and has caused them to regard the sanitary defects of their localities (which they, of all people, ought most to abhor and protest against) with overweening tolerance. Although this is, unquestionably, a bar to improvement, it arises from an error which is, in itself, venial and natural—the excessive development of a right feeling of admiration for that which is our own; an inclination to overlook and apologise for its defects, and a proneness to magnify its advantages; a tendency to be

> ". . . . to its virtues very kind,
> And to its faults a little blind."

In short, the foible of the men of Little Pedlington.

When I find a health officer, professing to write upon the remarkable salubrity of his very badly situated district, protesting that, in the month of August last, the mortality was under the annual rate of four in the thousand, and overlooking the fact that, within the past four years, the place was so direfully impested by a zymosis as to call for a special inquiry by the Local Government Board;—when I see it declared of a town which I know to be full of plague-spots, that, but for a visitation of diphtheria, its mortality-rate last year would compare favourably with the lowest in England;—when, I say, I find earnest, honest-minded men contending in this manner against plain facts, their mode of arguing reminds me of that of the Calcutta skipper who, on being told that he had made a remarkably slow voyage round the Cape, replied: "If you put aside our loss of a topmast and do not count the weeks in which we were becalmed, you will find that my ship made, out and out, the quickest passage of the season."

I believe that the establishment of the system now proposed would go far towards correcting this evil.

It is clear that I need not attempt to explain to an audience of eminent sanitarians the uses which these manuals would serve; but, as my remarks may be seen by others less instructed and experienced, I will pray you to bear with me for a few seconds while I offer one or two illustrations. In 1845, while I professed to practise in the parish of Lambeth, my father and I suffered from dysentery. I was then concerned in the editorship of one of London's two weekly medical periodicals; I was a member and active frequenter of five medical societies; I spent some hours of nearly every day of my life in communication with the best men at Guy's Hospital: and yet, strange to say, it was only about two months ago that I became acquainted with the fact that in the seven years, 1840-47, Dr. Baly examined post-mortem many hundred cases of dysentery in the Millbank Penitentiary, situated not a mile from my residence. "Yes," you may remark, "the oversights of some people are limitless!" Still, had Lambeth then possessed a health-history, I could hardly have remained ignorant for thirty-eight years of a fact which interests me personally. Again, imagine that an outbreak of enteric fever occurs on the twentieth day of a given month in Warwick, and that it is traced to pollution of the chief water supply with sewage matter: my first step in investigating this fact would be to consult the annual health-reports of the surrounding towns; and if I found that, many days previously, at the very beginning of that month

enteric fever had prevailed to an unusual extent in Worcester, Birmingham, Northampton, Bedford, Oxford, and Gloucester, or in more than one of those places, I should say that the fact tended to support a heresy which I confidently maintain, to the effect that enteric fever is of aërial epidemic origin, and that typhoid stools and sewage-filth are only operative as excitants of that disease.

Again, should it be reported that, cholera existing at Alexandria, a ship from that port had reached Southampton on October 20, and had landed a sailor who died of cholera on the 22nd of that month, whereupon the people of Southampton became impested,—I should consult the contemporary health-histories of the neighbouring inland towns, and, if I found that, ten days previously, unmistakable cases of cholera had occurred in any of these, it would add another fact to the many whereon I ground the strong belief which would enable me to declare that the sailor did not bring the plague to Southampton, but that the pestilence awaited his arrival there, and killed him under its law that new-comers are almost invariably its first victims.

I have no doubt that our esteemed colleague, Dr. Buchanan, has, in his office, all data needful in pursuing an inquiry of this kind; but is it possible to obtain such information elsewhere? If so, I, for one, know not where to look for it. I am aware that a few months ago enteric fever raged synchronously in Paris and in Egypt, and I have ever since desired to know whether England also suffered at all remarkably from this pest at the same time; but I could only learn this with precision by going about a great deal, and by giving needless trouble to over-worked men. Under the system which I propose, I should possess the needful information on my study table. Again, I long ago observed facts in India which led me to believe that neurotic paludal asthma is aggravated by residence at the seaside. The great experience of Dr. E. Headlam Greenhow has convinced him that this law obtains in England. Knowing that asthmatics frequently escape suffering on long voyages, I think that I am justified in inquiring, are certain localities hostile to the asthmatic because they are maritime, or because they are paludal, as so many English watering-places are? If I could examine the health statistics of all our watering-places, I might, not very improbably, arrive at a result useful to many grievously afflicted persons, by throwing great additional light upon the very important question of finding breathing-places for asthmatics; but, at present, my inquiry is at a standstill.

Read with sufficient care, the periodical supplementary reports would afford to every medical man in the empire a complete view, frequently renewed, of the geographical distribution of disease throughout these islands, and would add validly to his claim to be considered as a man of better information than the President of the Epidemiological Society can, at present, hope to be. Properly carried out, this work ought to become an invaluable aid in fulfilling the noble objects of our Society.

Complete series ought to be in the possession of every officer of health, and to be available in all public libraries and museums.

No man living values honest sanitation, or appreciates the good which it is very slowly effecting, more warmly than I do, but none who have studied epidemiology fairly can fail to join me in exclaiming against the fatuous over-confidence of shallow people, who ought to know better, who attribute every temporary mitigation in the incidence of disease to improved sanitation. He who has been tempted to declare that he has succeeded in stamping out the erysipelas which used to impest his hospital (a false position which I once saw occupied, to his speedy discomfiture, by a talented surgeon), and is shown, in the health-history, that the disease has lately attacked the neighbouring hospitals, and sees that it has now invaded his own, will wish that he had not spoken, and had kept his short-sighted exultation to himself.

I apprehend that some of my friends, on hearing that I recommend the publication of health *histories* of towns, will suspect me of preferring old facts to new ones. This, however, is a charge of which I consider myself guiltless. I have never valued nor brought forward an antiquated medical fact unless I considered that it threw distinct light upon our daily professional work.

Undoubtedly, well-chosen and judiciously-sifted historical facts would claim a place in the health-histories. Thus, in describing a pleasant breezy exercise ground for troops, upon which multitudes of handsome dwellings now abut, it would have to be stated that, a hundred years ago, men at drill used to be struck down by the pestilent exhalations from a neighbouring morass, which has now been very insufficiently improved, but which I remember in all its pristine deadliness. When I had the privilege of addressing you a year ago, I spoke of the natural disadvantages of the site upon which Southwark is built. When the health-history of that locality comes to be written, the following additional

facts, standing two hundred and ninety-nine years apart, ought to be cited. Suffolk Place and old St. Thomas's Hospital very nearly faced each other on either side of the great highway at the southern foot of Old London Bridge. An able writer, Mr. William Rendle, has lately given us* an old medical case which is most useful as illustrating the sanitary condition of that locality early in the sixteenth century.

In 1514, Charles Brandon, Duke of Suffolk, married Mary of England, the French Queen. They resided occasionally at Suffolk Place, notably in 1519 and 1522. The writer tells us that Southwark Palace must have been built in an unfortunate place. South of the river, the fields were freely intersected with small streams and ditches; bridges crossing these streams are shown in the earlier maps, here, there, and everywhere. Not unfrequently, the locality, being below the level of the river, was flooded. The district was, of course, unhealthy, and was always severely visited by the various plagues which never for long left England.

The insalubrity of the place is most likely the reason why Mary was so little in Southwark; as it was, she doubtless suffered from the marshy surroundings of her palace.

"In 1518" [when she was twenty years old] "some one writing of her says, 'it has pleased God to wyesset her wyth a nagu' (ague) 'wyche has taken her Grace hewarre' (every) 'third day.' She suffers from disease and pain in the side, a common result of persistent ague, but we are pleasantly told that her brother's kindness takes away a great part of the pain. . . . The French Queen gets worse and worse; physicians are consulted, but they do her no good. Writing from Croydon, Suffolk sadly says she has disease in her side and is very ill; he has been twice on his way to the Court, where he, for the time, seldom comes, and she sent for him to come hastily back, and will not have him away. She never gets better, but finally dies in June, 1533," after fifteen years' suffering from paludal splenic cachexia. Then in 1813, giving an account of old St. Thomas's Hospital, Sir Gilbert Blane described it as situated on a track of ground which was, originally, swampy, and no doubt aguish. In ten years, 192 cases of intermittent fever were admitted in Blane's wards alone; he, however, considered that these were not, principally, from the local population. Such reports as the following are also noteworthy, when well authenticated. On Saturday, the 23rd June 1883, Sir William Knollys,

* *Temple Bar* for February 1882.

Usher of the Black Rod, died of intermittent fever at his official residence at the House of Lords.

With a view to obtaining the best information regarding the health-histories of districts and towns, it would be well to seek the co-operation everywhere of the clergy, archæologists, and librarians.

I cannot doubt that, although the publication of these books would immediately encounter strong opposition from local stolidity and ignorance, it would not be very long before the valid utility of the measure would, by obviously enhancing their best interests, command the favourable attention of the most bigoted. At starting, such an undertaking ought to be received in a friendly spirit by all owners of healthy localities; while those holding improvable land and house-property would soon begin to find that the value of their estates was considerably raised, under reclamation, by augmentation of their rents. Those who absolutely oppose reform may well be allowed to howl until public opinion or the pressure of still higher authority constrains them to stand out of the way of progress. Recently, Dr. Samelson has directed attention to the fact that Manchester continues, in turn with Liverpool, to hold the position of the most unhealthy town in England, and has shown by official evidence that the unsatisfactory condition of the dwelling-houses, new as well as old, of the mass of the people must be regarded as one of the foremost causes of ill-health.* To the citizens of Manchester, that time-honoured sanitarian Edwin Chadwick has also very lately addressed arguments† which ought to awaken them to their real position as nothing else can until the peal of the archangel's trumpet strikes their ears, telling them that, had they not lavished their funds upon unproductive works, they might, ere now, have reduced their present average death-rate by ten in the thousand. The names of Chadwick and Samelson ought to have permanent record in the health-history of Manchester as standing prominently among those who had the courage to declare the city's malady, and the sagacity to demonstrate its remedies.

When the sanitary shortcomings of a place, and the means of remedy, have been for some time clearly set forth in a popular work within the reach of everyone, it is probable either that the inhabitants will be shamed or convinced into reform, a healthy rival spirit of comparison and emulation

* *Medical Times and Gazette*, vol. ii for 1883, p. 197.

† "On Sanitary Administration and on its Condition and Results in Manchester," 1883.

arising between town and town, or that local benefactors will generously relieve them of the work.

When the promulgation of these histories shall have accustomed people to the candid and fearless exposure of sanitary defects, we shall probably hear nothing more of that morbid sensitiveness which designates the most friendly of all criticism as libel. We might then learn to offer a public banquet and a service of plate to any chiel intelligent enough to spy a hole in our civic coats, and to suggest means for its repair.

If it can once be decided that a publication of this kind ought to be instituted, the manner of conducting it might be readily planned. While every district and important town would have its "History", these little works would be combined in one or two volumes for each of the three Kingdoms, purchasable at a remunerative price.

It appears clear that the system which I indicate could only be successful under the control of Government.

I think that health officers and medical men desiring to hold these appointments would contribute nearly the whole of the local articles, which, if worked out with due care, and fully acknowledged, would contribute much to the writers' professional reputation.

It is probable that nearly the whole of the needful Statistical, meteorological, and geological data stand ready for collation.

I believe that a director for each Kingdom, posted at London, Edinburgh, and Dublin, efficiently supported by officers of health, and assisted by a staff of about four highly qualified assistants, could prepare and publish the first edition of these works within a twelvemonth of the time of starting.

The cost of printing the local histories is doubtful; but I think that the average expense ought not to exceed £20. The cost of the annual supplementary reports would be small, and two officers at head-quarters could edit them. Consequently, there would be no heavy expenditure after the first eighteen months.

In the cause of suffering humanity, I should be glad to see this plan carried into effect not only in the United Kingdom, in India, and in our Colonies, but also in America and in every country throughout the civilised world.

ON SCURVY, IN ITS BEARINGS ON EXPLORATIONS BY SEA.

By Sir WILLIAM SMART, K.C.B., K.L.H., Hon. Phys. to the Queen; Inspector-General R.N. (*retired*).

(*Read: Dec. 5th*, 1883.)

If proofs were needed that English minds and English hearts are still true to the aspirations that were first awakened in the dawn of modern navigation, we find them in the enthusiasm with which the *Alert* and *Discovery*, under Nares and Stephenson, went forth in 1875, and in the widely spread disappointment on their return in 1876. Unsuccessful they may have been, but having done all that men could do, they acted under the courage of their opinions, that to delay, where no hope remained of success, would but keep up a constant drain of precious lives. And nearer to us we have evidence in the successful relief sent to an enthusiastic yachtsman, Mr. B. Leigh Smith, who had gone to explore F. Jozef Land, to which no other Englishman had as yet proceeded.

The remarkable incidents of these last two voyages have actuated me in this attempt to lay before this Society a *résumé* of some facts in the history of scurvy in relation to sea explorations. To have had these presented in juxtaposition for comparison, is such an opportunity as may never occur again. The first instance is that of a naval expedition, admirably officered, manned, and equipped with all the resources of modern science, which returned home after one winter in the highest latitudes ships have ever attained to, after suffering severely FROM SCURVY. The second is one of a well-found, small vessel, that boldly reached the latest discovered land in the north with incredible alacrity, having visited it the previous year. When lying at anchor in a bay, the pack-ice came in with the tide with such force that she was nipped between it and the land floe, and in a few hours she sank in eleven fathoms water. Only a small quantity of stores and provisions could be got out of her before she sank, on the 21st August 1881. On the 21st of June 1882, after ten months, they were able to launch their four boats and to push southwards towards N. Zembla, where they were picked up, on the 2nd of August, after six

weeks of dragging across floes and rowing, by a steam-whaler that had gone there to search for them, and which brought them to Scotland on the 19th of August. Their difficulties had been of no mean order, and yet not a case of scurvy had been seen among them. This is the contrast presented; but, before entering on consideration of it, it will be well to speak a little about scurvy in its pathological nature, its ascribed etiology, its prevention and cure.

First, then, it is a disease of general debility, with an altered crasis of the blood, commencing with anorexia, tumefaction of the gums, pains and weakness of the lower extremities, and tightness of the ham-strings, followed by hæmorrhagic tendencies displayed under and on the mucous surfaces of the gastro-enteric, renal, and urinary tracks, into the muscular tissues and under the skin and periosteum, and ending in serous and fibro-plastic effusions in the serous sacs and the areolar tissue of the limbs: the pathological cause being the alteration in the blood that precedes, *pari passu*, the series of structural lesions above described. Mr. Busk, who had seen much of the disease in the Dreadnought Hospital, found this condition to be, microscopically, an excess in the watery and a diminution in the solid proportions, with increase of the white and decrease of the red particles of the blood, also increase of its fibrinous and albuminous constituents, together with a diminution of the vital cohesion of the fibrine.

In the year 1699 there was a great epidemic of scurvy in Paris, which Poupart dealt with in the Hôpital St. Louis, where he observed the disease extending, in its extreme degree, to serous effusions under the periosteum and perichondrium of the ribs, with sponginess and caries of their loose ends, and necrosis of their cartilages, which lay detached in their capsules. Of late several London authorities have described a disease among ill-fed infants, more generally known as acute rickets, in which the long bones have their periosteum separated from the shafts by copious blood extravasations, which disease they find curable by anti-scorbutics, with a better and more natural diet, and therefore they propose to class the disease as Anti-Scorbutus. Dr. Lind, physician, of Haslar, in the latter half of the last century, to whom we owe the only classical work on scurvy, had seen such extreme cases as Poupart described. Lind's work has been recently reprinted in Paris, which indicates its modern value; and being a rare work among naval and mercantile surgeons, it would bear reprint, with additions up to our time, in its native tongue, especially as the disease has been of late but too prevalent in our mercantile marine.

As to the etiology of this disease, this great authority discarded the prevailing theories that the salted meats of seamen was a direct cause, *further than their being less digestible, and therefore less nutritious*; and he taught that the want of vegetable food was not alone its cause, His views of the predisposing and exciting causes are summed up in these words at p. 516:—"I am fully convinced, in my opinion, that whatever weakens the constitution, and especially the organs of digestion, may serve, without any other cause, to introduce the disease in a slighter or higher degree, even among such as live upon fresh garden vegetables, or the most wholesome diet in the open air." These are important words from the pen of a physician so experienced as Dr. Lind was in this disease, that *more than the privation of vegetables is required to produce scurvy.* When it appeared in England, Scotland, and Ireland in the springs of 1847-8-9, it was attributed to the potato blight of the preceding years, and consequent privation of vegetable food of the lower orders; but it must be recollected that, especially in Ireland, a general state of famine prevailed among the poor, a want of every kind of wholesome food, besides having the standard vegetable supply in great deficiency as well as defective. Lind relates "that he had known seamen's messes in which vegetable food was not used above twice or thrice a month during three years, and yet there was no scurvy". "That in 1759-60 there were two frigates employed in conveying merchant ships between Plymouth and the Downs, touching at Portsmouth, being seldom above forty-eight hours at sea, and during twelve months their crews had not any salt provisions oftener than once or twice a fortnight, but notwithstanding the constant use of fresh beef and vegetables, greens, etc., the companies of both ships became greatly afflicted with scurvy" (v. p. 27). "That now, in July 1771, I have under my care several men very ill of the scurvy sent from the guardships at Spithead, which ships have never been at sea. These men, being pressed into the service six or seven months since, and not permitted to come on shore, solely from confinement on board ship, became highly scorbutic" (v. p. 519). "That Porchester Castle being full of French prisoners in 1760, hulks were employed, in which they had the same rations of beef, fresh bread and beer, etc., as those within the castle walls, with an open quadrangle; but these remained free from scurvy, while those cooped up between decks became scorbutic." Other striking instances could be cited to show that something beyond diet alone is required to generate the

scorbutic diathesis. And what is that something? To which the safe reply is, "Not yet sufficiently known; but usually multiple." Formerly the pure sea atmosphere itself was, by some, thought nocuous, on account of the saline particles in it, and sea-salt was deemed more so than rock-salt; others considered the odours of bilgewater to be productive of the disease; and others—to which Dr. Lind assented—that constant dampness of the ship's atmosphere between decks was an efficient exciting cause. At that time it generally took about six to seven weeks to generate the diathesis in the Channel squadrons, and ten or twelve weeks to develop it fully.

In the autumn of 1780, the fleet, under Admiral Geary, after cruising for ten weeks in the Channel, returned to Spithead with 2,400 cases of scurvy in it. And after Lord Howe's action on the 1st June 1794, the fleet, being kept at sea, became almost disabled by scurvy. Long previous to these destructive events, the force of general prophylactic measures had been fully demonstrated in 1759, in the fleet of Admiral Hawke, that beat the French fleet in the Channel in November. At sea from the 12th May until December they had had no scurvy. Lind was a great advocate for dietary prophylaxis; and on that occasion his advice was taken to supply the Channel squadrons while at sea with fresh animal food and vegetables by means of tenders, which plan was so successful that, on the day of the great fight, some ships went into action without any men on the sick list. It may be assumed that scurvy would have appeared as usual without the observance of these measures.

Of fatigue as an exciting cause, he writes as follows:—"Lastly, troops that have undergone much fatigue, as also sailors who have been worked very hard, may become affected with this disease." And he admits within the category, mental depression, moral emotions of a lowering character, and habits either of an individual or class character; but in all such instances the scorbutic diathesis must be pre-existent. And it was not uncommon for ships, on arrival from sea, to send one-half of their men to hospital with scurvy, and to receive them back again in a fortnight, cured by change of diet and atmosphere.

Neither heat nor cold, nor wet, nor darkness, nor hard labour, can rightly be judged adequate alone to be the cause of scurvy, for it had occurred under either of these circumstances; so that, at the most, they may be considered as developing causes where the essential change in the crasis of

the blood has commenced, however faintly, through malnutrition, either in kind or in quantity, to meet the wants of the system. In the Arctic regions the Esquimaux will consume 8 lb. of flesh and blubber at a meal. Sir John Richardson and Admiral Pullen, an officer who conducted in 1850-51 a boat and sledge party from Behring's Straits across to Hudson's Bay, said their men would consume with ease 4 lb. of any fresh meat, and that scurvy was not known to them, and that for a great portion of their journey they had no bread.

In this matter of the prevention and cure of scurvy, Dr. Lind adopted the maxim, *Dies docet diem*, when impressing the necessity for maintaining ventilation and dryness of ships, frequent supplies of animal and vegetable food, with abundance of wholesome water for drinking and cleanliness of person and of clothing, as sanitary preventives, and of robs or syrups of lemons and oranges, as remedies for scurvy. We shall find in the history of this disease that this maxim has been frequently applicable throughout.

The history of the disease dates nearly as early as the Christian era, as Pliny relates that the army of Germanicus, at the mouths of the Rhine, was afflicted with it, and that it was cured by a plant called *Herba Britannica;* from which it may be inferred that the disease was known where its remedy was procured from, and, consequently, that it was a disease of the Ancient Britons. It is told, too, that the army of Aetius, in the parched deserts of Arabia, early in the fifth century, suffered greatly by it; and it is believed to have been the disease that wasted the army of St. Louis after landing near Tunis, in A.D. 1270.

In our own expeditions it has been the root of infinite disasters in the West Indies, in the conquest of Canada, at the siege of Quebec; and in Egypt, under Sir R. Abercrombie, whose army of 27,000 men in 1795 was reduced by it to barely as many hundreds in the short space of two years. Our army at the Cape of Good Hope in 1847 suffered from it; and in the Crimean camp it was well known in 1854-5. But its baneful results were not only evinced in typical form, but as underlying the fevers styled putro-adynamic, with large dark maculæ, vibices, and weals of blood. It also affected our army employed in the Indian Mutiny in 1857-8. In truth, it was a disease on land ages before it was ever seen at sea, not likely to have been prior to the early voyages of the Dutch to Spain, and the long voyages made to the New World and to India, in which, most likely, it presented a more typical and less complicated form, causing

it to be named sea-scurvy; leading seamen, at length, to the discovery of its true nature, its causes, the means of prevention and cure, of which the main principles are taught in the *Surgeon's Mate* of John Woodall, published by him in 1615.

It will interest to show how much the early circumnavigations were impeded by fierce epidemics of scurvy, and how these were on several occasions relieved by arriving where seals and shell-fish were obtainable, and how they were thoroughly cured when arriving at islands on which their crews could be landed from their ships, where fresh animal food, with fruits, were procurable.

MAGELLAN—the first circumnavigator—sailed from Spain in 1519, with five ships of considerable size, manned with conscripts, and in 1522 one of his ships returned alone, with only thirteen out of her original crew of 234 men, after a voyage of three years and thirty-seven days. They used seal-flesh, and ate the leather that was on the rigging.

DRAKE, in 1577, sailed from England with five small vessels, and crews of volunteers—largely of gentlemen adventurers—in which scurvy appeared in the Straits of Magellan, and was cured by the flesh of seals, penguins, and herbs they found in Terra del Fuego. On Chilo Island they procured cultivated vegetables. Sailing along the coast northwards, they sacked the Spanish settlements, and took much "*of wine, bread, and bacon, as well as of treasure.* And when satiated with these, they attempted a N. East passage home, and failing it, they again were touched by scurvy, from which they sailed south again, and were restored to health on an island abounding in seals and penguins. California they took possession of in the name of Queen Elizabeth, as New Albion, of which country the natives crowned Drake as their king. They crossed the Pacific to an island south of Celebes, where they obtained the refreshments they were in want of, on account of scurvy, for the third time. Being restored to health, they visited Java, and then sailed direct to the Cape of Good Hope, touching nowhere before they got to Sierra Leone, where they were refreshed on oysters, lemons, and pure water." Of the five ships only one reached England, after two years and ten months, with a vast amount of treasure. Many officers and men met with violent deaths, of which the chaplain tells; but, although the scurvy was among them thrice, the chaplain makes no reference to any deaths by it. The stamina of Drake's men was vastly superior to that of those of Magellan, who were starved in the Pacific, and to those of his successor—after a long

interval—who were mostly of impressed seamen and worn-out Chelsea pensioners.

The next great circumnavigator was ANSON, 1740-44, of whose voyage the history by Mr. Walter, the chaplain, is so much read that all know of the dreadful mortality in his ships, of which there were six at starting, with very weakly crews, of which the famed *Centurion* alone returned, after three years and a half, of which she had passed one year and a half in various harbours. The first and the last of these voyages will serve for ever to exhibit the horrors of scurvy in these early explorations by sea, both when in cold, tempestuous climates, and also when in the hot regions north and south of the equator. In one of them (Anson's) there was never a great want of the necessaries that crews depend on; while in Magellan's, scurvy was combined with famine. The intermediate voyage of Drake is one instance, interesting on account of its early date, in which the inherent spirits of a high-class crew, combined with the almost unbounded success of their enterprise, would seem to have kept down the scorbutic diathesis, without, at least, any remarkable mortality; but their great captain exhibited then, as at later periods of his career, how much his movements were governed by considerations for the health of his crew.

One of Anson's ships was the *Wager*, in which Byron was a midshipman, to whom we owe the tale of the disasters that befell her crew. After rounding Cape Horn, the squadron was dispersed by tempests, and two of the ships made the best of their way to England, while the others suffered terribly from scurvy. The *Wager*, of 28 guns and 160 men, was driven on an island, now named Byron Island, on the west coast of Patagonia, at a time when, from scurvy, only twelve of her men were able to work to try to save her from wreck. They subsisted on mussels and seaweed principally, as only a small quantity of provisions could be saved; but they got well of the scurvy, and were then reduced by famine. A mutiny occurred, when they were reduced to ninety-one, and of these seventy-one seized the larger boats and sailed for the Straits of Magellan, while twenty, including the captain, remained. Of the seventy-one only thirty, and of the twenty only four, got back to England. They were reduced to starvation, but scurvy was not again mentioned, and but for the help of the Patagonians not one of the smaller party would ever have reached a Spanish settlement; and the four who did so were officers.

Byron was entrusted, in 1764, to circumnavigate with two ships of war, of which the crews were promised double pay

—as an encouragement—being the first instance recorded. They reached Rio de Janeiro without any accident, but one of the ships was sickly, and her crew were lodged ashore until they had recovered health. At the Straits of Magellan they found a storeship awaiting them to complete their provisions. Early in April, on leaving the Straits, the health of the crew was good, and it would appear they had had fresh animal food, for they touched at several islands. At the end of three months the scurvy had made much progress in both of the ships, but those seized were cured by food of wild-fowl and cocoa-nuts, got from an island in the South Pacific, on leaving which the scurvy returned, with flux. After three months out they reached Anson's Island of Tinian, where they landed—the *Commodore* having scurvy, which changed there for "fever", while fed on pork, bad beef, and poultry. At that time their bread was rotten and worm-eaten, and their beef and pork were putrid before they reached Batavia, late in November, and there they cast off diseases, and reached England, after a voyage of a year and ten months.

This expedition marks an epoch in the history of exploring voyages, as it put an end to the erroneous system of coupling discovery with acts of war; and instead of a squadron like Anson's, this was of two ships only, as companions in case of one being wrecked and abandoned, which has been the usual practice since then; and, moreover, an inducement to perseverance was given in the form of double pay, with a slight improvement in victualling. Probably this was done by influence of Admiral Sir Charles Saunders, who had a command in Anson's squadron.

Byron returned in March 1766, and in September his ship—the *Dolphin*—left England once more, with two companion ships, on another exploration, under Captain Wallis. One of the ships was left at the Cape Verde Islands, and the other two had scurvy when they reached Magellan, where they remained at Port Famine, using seal-flesh, wild-fowl, fish and mussels, vegetable food, and frequent sea-bathing, until they had recovered from it, when they were afflicted with flux, attributed to the mussels they consumed. In crossing the Pacific the crews suffered much from fevers, until discovery of Otaheite, where they obtained abundant fresh supplies, and were quite restored to health. Afterwards they visited Tinian and Batavia, where they again suffered from flux, but without any deaths, and on leaving there were only two sick on board. Soon after, when at Prince's Island, they buried three men, who died of an infectious putrid fever; but they put to sea before it was extinct, and on

arriving at the Cape of Good Hope the sick were landed and placed in tents away from the town, in which there was small-pox, from which they were protected by a cordon, and escaped it, and returned to England, after a voyage of a year and nine months.

Twenty-five years after Anson's return, and two after that of Byron, the celebrated Captain JAMES COOK commenced his illustrious but sadly-ending career. In 1768 he left England, and returned in 1771, in two years and nine months and a half, having made grand discoveries in Polynesia, New Zealand, and New Holland, tracing its eastern coast from its southern to its northernmost cape, in doing which his crew became weakened and, doubtless, scurvical, but none died of the disease. After refreshing at Rotté, in the Sea of Timor, he went to Batavia to repair his ship, that had been twice on the rocks within the great barrier reefs of Australia, and while doing this his crew was landed on an island. The climatic remittent fever broke out among them, and before they could get free from those seas there were thirty of eighty-four dead of fever and dysentery, seven of them officers, which began in a week after their arrival at Batavia, with systems weakened by the preceding scorbutic diathesis.

In his second voyage, from 1772 to 1775, he again circumnavigated the world, profiting by his former experience. Having but little faith in vegetable antiscorbutics, he relied on general sanitary measures, and he was well furnished with the best kinds of ship's diet, with sour-krouts, malt for brewing a sweet wort, and vinegar, with preserved soups and the robs of lemons and oranges for the sick, and with an ample supply of new clothing for frequent changes when wetted. Being left entirely to his own discretion as to his track, he took great care to visit at frequent intervals the places where he knew that fresh animal and vegetable foods were easily to be procured, with fresh supplies of good water, to be used not only for drinking, but for the purposes of cleanliness of person and of wearing apparel; and he took great pains not to overwork his men, and to ventilate and to keep dry his ship.

In that voyage the scorbutic diathesis displayed itself three times; at first between the Cape of Good Hope and New Zealand, when the stock of sheep was thinned by scurvy; the second while skirting the Antarctic ice; and the third whilst rounding Cape Horn, from which he went out of the direct course home, to the Cape of Good Hope, to send his sick ashore, and to replace the biscuit in store, which was very corrupt. His ship reached England after a voyage of

over three years, having lost only one man by disease, and that not the scurvy. For this grand exploit he received from the Royal Society the well-merited honour of the Copley gold medal—the highest award at its disposal.

In that voyage there were two vessels, his own being by far the best sea-boat, in which, in bad weather, it was much less difficult to maintain ventilation and dryness than in the other, which suffered badly, losing several of her men by scurvy. Twice these ships were separated by tempests, and, not meeting again, the sister ship bent her course to England, where she arrived a year before Cook's ship, with a very different tale to be told of her distresses.

That voyage left a mark profitable to all future exploring expeditions by sea.

The great wars with France and Spain kept in abeyance the desire for voyages of discovery, but as soon as they were over it arose again, and directed itself to the discovery of a N.W. passage, which, in the peaceful days of King James the First, had given England the glory of the discovery of Davis' Straits and Baffin's Bay, to the western exit of Lancaster's Sound and Smith's Sound; and also of Hudson's Straits and Bay, since which all further discoveries in those directions had been checked and unprosecuted, although the further terminus of Behring's Straits had been discovered by Russia in 1722, and the fact of great American rivers discharging into the Northern sea, by Englishmen in 1771 and 1789.

In this resuscitation attention was at first directed to Spitzbergen by Scoresby in 1808, who found an open sea in 78°—80°. In 1818, Captain Buchan, R.N., was sent to it, with a staff of young officers who have since made themselves famous in the waters leading from Baffin's Bay.

In 1819, Ross and Parry went to Baffin's Bay and examined its furthest inlets, Lancaster's Sound, and Smith's Sound. In 1820, Parry entered Lancaster's Sound, discovered P. Regent's Inlet on the south and Wellington Channel on the north. He penetrated westward to Melville Island, and wintered there, obtaining reindeer and game, not, however, sufficient to prevent scurvy among his crews. In his second voyage, in 1822-24, he spent two years in seeking a passage into P. Regent's Inlet from Baffin's Bay, south of Lancaster's Sound. In the first winter, one officer had scurvy, and in the second winter an epidemic of it began among the officers severely, and then among the men. His third voyage was made in 1824-25, to attempt to reach the mouths of the continental rivers, through Lancaster's Sound and P. Regent's Inlet, in which he failed; but, spending a winter there, they had no

scurvy in it, as in his first voyage while wintering on Melville Island.

The next exploration in the same gulf was made by the two Rosses—uncle and nephew—who passed four winters in the ice, 1829-33. In their first two winters they were exempt from scurvy, through gaining from the natives ample supplies of seal-flesh and game; and in the spring seasons they obtained large supplies of salmon going to spawn in the continental rivers. By sledging, important discoveries were made —1st, of the Magnetic Pole; 2nd, of K. William's Land; and 3rd, that there was no passage between the end of the gulf towards Behring's Straits. Their work being finished at the end of the second summer, they were very disappointed at being frozen up again; and in their third winter scurvy attacked all badly. In the spring they left the ship and travelled by boats and by sledges to Fury Beach, where they improved in health, so as to reach the ice barrier of Barrow's Straits, from which they had to return to Fury Beach for a fourth winter. Scurvy revisited them in the spring, and an officer died of it; but they were fortunate in the summer to get to Lancaster's Sound and return home on board a whaler.

Their small mortality through two winters, with the scorbutic diathesis strongly in them, although getting less fresh animal food than previously, can only be accounted for by necessity driving them to live in a hut in two winters, and in tents or boats in the open air, in the last two summers of their stay in Arctic regions.

Parry and Ross having cleared away many obscurities and disproved many uncertainties, efforts were not renewed till 1845, when Sir John Franklin's expedition of two ships was equipped, with every precaution, for three years. They wintered, 1845-46, at the entrance of Wellington Channel, and left three graves there, but whether as the results of scurvy is unknown.

The ships were beset in the ice on the N.W. coast of K. William's Land, about 360 miles south of Barrow's Straits, and about 200 miles N.E. of Point Turnagain, as named by Franklin in one of his boat journeys.

The second winter was passed in that situation apparently without scurvy, but Franklin died early in the second summer. The third winter came on them still fixed in the dense pack, and during it they lost several men by scurvy; and their provisions must have been nearly exhausted at the end of that season, in which they may have been unable to procure any game, as the natives have reported that at that time

the severity of the climate had deprived them of subsistence on K. William's Land. In the fourth summer the ships were abandoned by the famishing crews, in the hope of reaching the continent; but, scurvied and dropping dead on their path, none lived to reach the nearest points of semi-civilised society. As in the voyage of Magellan in 1519-23, so in tnat of Franklin in 1845-48, scurvy and famine wrought destruction still more complete by their bitter complication.

The non-return of the Franklin expedition duly led out several search expeditions—governmental and private—from 1848 to 1879, by sea, through Davis' Straits and Behring's Straits; and by land across the Hudson's Bay territory. The complete expeditions of the nation brought back no information, leaving the whole mystery to be unravelled by single small vessels sent out by Lady Franklin, under Penny and McClintock, and by expeditions on land conducted by officers of the Hudson's Bay Company—Dr. Rae and Mr. Anderson —and by American volunteers, Mr. Hall and Lieutenant Schwatka, with Lieutenant-Colonel Gilder.

The land expeditions, being mainly made up of natives, able to meet all their wants by the chase and with the net, had immunity from the scurvy; and so had the expeditions through Lancaster's Sound, except that in the yacht *Fox*. Captain McClintock, R.N., who, in 1857-59, following the track of Parry in 1824-5, and of John Ross in 1829-31, discovered the scene of Franklin's disaster in 1859, after being one winter in the Gulf of Boothia, having some scurvy in his sledge parties in his second spring out of England.

One of the crew—an intemperate man—died of scurvy on board the *Fox* in the second winter; but the sledge parties, that had got it while absent from the ship, recovered quickly after their return, on the animal food they received on board her, with beer and lime-juice. The *Fox* returned home at once, and proved the advantage of steam-power in a small vessel employed on Arctic exploration.

Other expeditions were sent on the search through Behring's Straits, and of these the *Investigator*, Captain McClure, escaped scurvy in her first winter on ship's resources, and in her second winter; in Mercy Bay, having there an abundance of reindeer flesh. Then they suffered a great disappointment, which was quickly followed by scurvy in the third spring, in spite of some sorrel and of much flesh diet, even with which they felt the pangs of starvation. The scorbutic diathesis once established, although again subdued, remains latent, so that it flashes out again, after a shorter exposure to the exciting causes, as was displayed in all the earlier circum-

navigating voyages. And the future of the *Investigator* proves also, what was evidenced in Parry's second voyage, that after the blood dyscrasy has attained a certain degree, it is ineradicable by the antiscorbutics, fresh animal flesh, preserved vegetables, and lime-juice, if the sick be detained longer in Arctic regions.

To the expeditions under Austin Belcher and Kellett, in the main channel from Lancaster's Sound to the westward entrance between Bank's Land and Prince Patrick's Island, we are indebted for knowledge that steamers can pass so far in a single summer; that reindeer, musk oxen, and hares abound in the north-west islands of that archipelago in the summer, some of them remaining through the winter; and, lastly, that 40,000 miles may be travelled there with sledges drawn by men, in journeys extending to eighty days in duration, without the appearance of scurvy, although in the journeys lime-juice may not have been generally administered as its special preventive; for, notwithstanding a very low temperature, with great fatigue during their long marches, they dwelt in the open air with constant daylight, and they procured more or less of game, and sometimes sorrel.

The search for the missing expedition aroused much private enthusiasm in the United States, and Mr. Grinnell, one of their princely merchants, fitted two expeditions to assist in it. The second of them went, in 1853, to Smith's Sound, under Dr. Kane, in the *Advance*. She was frozen-in two winters in 78 deg. 37 min. N. lat.; and in the next summer, sledges sent northward from her reported *an open Polar sea* in 81 deg. 22 min. N., and a cape beyond it in 82 deg. 30 min. The *Advance* remained another winter frozen up, and in the next summer (1855) she was abandoned. The wants of the crew had been much relieved by supplies of the flesh of walruses and seals from the Arctic Esquimaux; but most of them had fallen ill of the scurvy. They took eighty-three days in sledges and boats to reach Upernivik, undergoing great sufferings; but, living as they did in the open air, with walruses, seals, and birds to feed on, they got well of the disease. In the second summer, Dr. Hayes, with half the crew, left to travel southward to get home, but, after undergoing great privation through several months, they were compelled to get back to the *Advance*, where they found scurvy prevailing, when they had none. (Appendix A.)

In 1860, Dr. Hayes, in the schooner *United States*, wintered at Port Foulke, ten miles south of Kane's position, and in the spring he ascended in sledges to 81 deg. 35 min. N. He found abundance of reindeer, walrus, and seals at P. Foulke;

his men had no trace of scurvy, and in the second summer he returned home in his ship.

In 1871, Captain Hall of Cincinnati, in his vessel the *Polaris*, by keeping near to the west coast of Smith's Sound, in an endeavour to reach the North Pole through the open sea descried by Kane's sledge party, reached to 82 deg. 16 min. N. lat., and then, crossing to the eastern shore, he anchored in Thank God Harbour in 81 deg. 38 min., where he wintered, and in November he died there of paralysis. In the summer of 1872, the *Polaris* was set free, but, getting fixed in the pack and upset, she was abandoned in October in Baffin's Bay. The crew were thrown on the ice, but, as the ship righted again, a portion of them returned to her, while twelve of her crew and eight Esquimaux remained on the floe with the boats and some provisions. They made a dwelling-place under their turned-over boats, and were drifted on the ice, subsisting through an awful winter on the flesh of seals and that of a bear and birds, while drifting 24 deg. to the southward; and after six months of great privation they were picked up by a steam whaler, and thus they got to Newfoundland *in good health*; ten of her people, who preferred to return to the ship, wintered a second season in Whale's Sound, having a sufficiency of ship's provisions to depend on, with fresh animal food also.

These instances occurred in the same channel where the *Alert* and *Discovery* wintered in 1875-76.

In 1860, the Austrian Government entered on Arctic exploration by sending the *Germania* steamer, with seventeen, and the *Hansa* sailing vessel, with fourteen men, under Capt. Koldewey and Lieutenant Hegemann, to the east coast of Greenland. In October the ships were separated, and the *Hansa* was crushed by the floes when alone, and sank in 0 deg. 52 min. N. lat. Her stores and provisions were drawn upon the ice, and a hut was constructed of slabs of patent fuel. From November they had the flesh of walruses and bears. In January their floe was reduced to 150 feet in diameter, by pressure of icebergs. After spending 200 days on the floe, they launched their boats into open water, and had, again and again, to drag them across the floes; but, their only case of scurvy having recovered, they were all able to work, and their appetites were unbounded towards seal-flesh and walrus-blubber. After ten months' drifting, they for the first time hauled up their boats on the east coast of Greenland, and refreshed themselves on salads of sorrel, dandelion, and cinquefoil. Assisted by the currents, the three boats rounded Cape Farewell, and reached Friedrichs-

thal in thirty-seven days, on the 14th of July, after ten months of peril and exposure, all well, and no death having occurred.

The *Germania* wintered among the Pendulum Islands of East Greenland, in 74 deg. 30 min. N. lat., and in March 1870 her sledges reached to Cape Bismarck, in 77 deg. N. Through the winter they had occasionally the flesh of bears, walrus, and seals, all of which they learned to appreciate; and in April musk oxen, reindeer, and small game became plentiful. In the winter there was but a single case of mild scurvy, which got well in April. On the 21st August they weighed anchor, and met their companions of the *Hansa*, on arriving at Bremen, on the 11th September 1871, after a separation of about a year, all in good health.

In 1872, an Austrian steamer, the *Tegethoff*, with twenty-two officers and men, was sent to seek the N.E. passage, north of Nova Zembla. On the 20th August she was beset in the ice, with which she drifted until the 30th August 1873, when, the mists lifting, she was found to be in 79 deg. 43 min. N., off an unknown country, which they named Franz Josef Land. In the spring of 1874 they explored the land. On the 20th May 1874, after nearly two years' fixture in the pack, like the *Erebus* and *Terror*, she was abandoned; and, as in that case, the remaining crew, nineteen in number, took to their boats on sledges, when their difficulties became so great that, after two months of unceasing toil, they were only eight miles from their ship. Then they were able to use their oars, and by dint of these, and dragging the sledges and boats over the floes, they got to the border of the ice barrier, in 77 deg. 40 min. N., on the 15th August, after about three months from the ship. In each of the two winters the sun was absent 125 days.

Scurvy, in severe form, attacked the men (nineteen in number) in both winters; but as the spring advanced they got well, except the engineer, who died of it, complicated by phthisis. On the day of their departure from the ship all were healthy except two men, who were borne on the sledges till they recovered.

Their rations were chiefly of preserved meats, with boiled beef, pemmican and bacon, fresh bread, butter, etc.; and for their second winter they had reserved several hundredweight of potatoes, and lime-juice was given. In addition to these there was plenty of the flesh of bears, of which they shot sixty-seven in number, and more in the summers.

This was added to with the flesh of seals, and of birds, and of foxes; but the musk ox and reindeer were animals un-

seen by them. That with such a diet through the year they should have had scurvy, in both their winters, is very remarkable, as in all the later expeditions of the western hemisphere since Parry's second voyage, 1822-24, scurvy had been warded off for at least one winter. Very probably it may have been developed by causes assignable to ship life in winter, as with the advance of spring, on two occasions, the sick recovered.

Previous history has displayed the fact, in the cases of Parry, Ross, Franklin, McClure, and McClintock, that the ordinary resources of a ship will serve to ward off scurvy without much, or with no fresh animal food; but that even with much of it through the first summer and in the beginning of the second winter, yet towards its end scurvy may appear, to be again driven away by the renewed abundance of animal food in the spring; but after that the constitutions of the men will be found to have undergone so much of the diathetical changes in the blood, that in a third winter of exposure to any exciting causes, the insidious disease will reappear in a form that resists the antiscorbutics of lime-juice and all other remedies, rendering it very dangerous to remain longer in Arctic regions. And thus the conclusion is arrived at, whenever or whatever it may appear in a first winter, there must be exceptional reasons for it.

In the year 1875, when the success of Weyprecht and Payer was still unknown, our own Government sent out the *Alert* and *Discovery* to make an effort to reach the North Pole, by way of Smith's Sound, in the track of Inglefield, Kane, Hayes, and Hall. These well-equipped steamers went beyond their predecessors, and the *Alert*, under Capt. Nares, wintered in 82 deg. 25 min., on the exposed western shore of the Polar Sea, while the *Discovery* remained in a sheltered harbour, in 81 deg. 45 min. N. lat.

Throughout the winter the *Discovery* found, happily, a sufficiency of fresh animal meat to keep her crew so far exempt from scurvy that there was only one exceptional case; and in the *Alert*—the furthest north of the two ships—not having anything like a similar supply, one case was seen in January, but a strong scorbutic diathesis displayed itself among her crew in the spring of 1876, but not before the heavy sledging work was commenced. Among the exciting causes of the outbreak there must be rated the greater inclemency of the winter climate in her more northern position, that necessitated, as it was considered, an extreme attention to maintaining warmth within her, that counteracted and prevented a due amount of ventilation, so that she had much

dampness and moisture in the inhabited parts of the ship, and scurvy showed itself on board her about the same time as it did in her sledge parties when distant from herself.

In April the sledge parties were sent off, of which the principal was that towards the North Pole, with two boats to drag, which, with incredible labour and privation, reached so far north as 83 deg. 20½ min. N. lat., within 400 miles of the Pole, and then, after seventy-one days' absence, returned to the ship, with the men sorely distressed by scurvy, and with the loss of one man by it. The second party was directed towards the west, and returned, from 85½ deg. W. long., in eighty-three days to the *Alert*, with the men in the same state as those of the northern sledges, but without a death having occurred. The third party went to Repulse Bay (Hall's furthest), on the Greenland shore, to explore the coast to the north-east, and there divided into two parties, of which one proceeded south-east to explore Petermann's Ford, and the other to the north-east to trace the northern coast of Greenland. They met again at Polaris Bay, the former free from scurvy; and the latter, of which the commander, with one man only, had looked into the Polar Sea of ice, from the summit of Mount Hooker in 82 deg. 30 min. N., with all the men ill of scurvy, and two deaths by it out of sixteen men. While journeying across the thawing ice, which rendered their progress most laborious, they had no fresh animal food, through from six and a half to ten weeks; but at Polaris Bay they began to recover, when obtaining much walrus and seal flesh. They were absent from their ships 117 days, including the stay recovering their health at Polaris Bay. On return they found the men of the *Alert* in as bad a state as themselves, while those of the *Discovery* were in good health. It is noticeable that in the Greenland party, made up of men taken from both the ships, an *Alert* man was the first to fail and die.

The work they went out to do had been done so far as it was practicable, and the scurvy was uneradicated; so that, following the example of the great Parry, Captain Nares considered it prudent and right to make the best of his way homeward.

The story of the *Alert's* epidemic of scurvy, in a first winter in the Arctic region, may find no parallel nearer than Parry's first voyage in 1819-20, and in both there was the same attributed cause, viz., dampness of the dwelling-place, to which heat was superadded.

So far as the operation of these on scurvy may be illustrated by a single case, there is evidence from Parry's first voyage, of an officer, whose cabin was constantly damp from

being near the stove, who took scurvy badly in it, and got well when removed to a drier though colder cabin. Mr. Edwards, surgeon of this ship, assigned, as the chief causes of the disease, "a diet deficient in quantity or quality; a cold, damp, and impure air; uncleanliness; habits of idleness; mental disquietude; and, in short, whatever is capable of producing debility," as Lind had done. He says: "Of the remote predisposing causes . . . a cold and vitiated atmosphere was the most to be dreaded"; and he explains the difficulty of obviating that condition on board, while striving to maintain a tolerable degree of warmth. He adds: "The external air during the winter months, which constitutes three-fourths of the year, is pure, clear, and dry, and rarely undergoing any very sudden change. The clothing of the men was found adequately warm to protect them from the severest cold, which they were enabled to confront, not only with impunity, but with a degree of profit and pleasure."

These observations seem to me to contain the key to the question of how to maintain health in Arctic voyages. No cause has been suggested so probable as that intimated by Sir G. Nares, viz., the warmth and moisture of the air between decks. On this the question arises of how to obviate that, by imparting sufficiency of heat while maintaining ventilation adequate to keep down that excess of carbonic acid, which is stated to have risen to .35, in lieu of the normal of pure air, there necessarily vitiated further by a relative amount of the skin excreta vaporised in an apartment crowded with persons not enjoying the ordinary means of ensuring cleanliness of person, together with those impurities inherent to the shut-up spaces in ships from material causes.

When naval sanitary engineering shall have solved this difficulty, it may be hoped that the wintering in Arctic climates will be exempt from such visitations of scurvy as the crew of the *Alert* suffered from in the winter of 1875-76. This was the apparent opinion of Dr. Frazer, judging from the tenor of his examination of witnesses before the Arctic Committee in 1877. Else how can it be explained that men subjected to the very extremes of human endurance in Arctic regions, as in the voyages of Kane in 1853-4; boat refugees of Hall in 1871-2, in Smith's Sound; of the *Hansa*, that sank on the east coast of Greenland in 1871, in which the crew drifted 1,500 miles on the ice in ten months; and others that we have still to refer to, have not been swept off by scurvy while enjoying open air and fresh animal food?

It may be assumed that the higher in N. lat. exploring

expeditions have proceeded, the greater has been the predisposition to scurvy; but this has been dominated by isotherms, as the regulators of the animal food supply, rather than by parallels of latitude, which indicate only the nearness to the North Pole itself. The length of the Arctic night is ruled by the parallel attained to, and as during it the crews have less active duties, they consequently pass a monotonous period of confinement to their ships proportioned to the length of the night. It may be that the predisposing causes are effective according to the shorter or longer darkness; but that is also the period when less of fresh animal food is procurable, which is a predominant exciting cause of scurvy.

The *Alert* was only forty miles north of the *Discovery* when the scurvy-diathesis appeared in her alone, which could hardly be attributed to a few more days of darkness; but the *Discovery* enjoyed much more fresh animal food during the dark period, which must have acted positively as a preventive. Again, Pelham and his companions in Spitzbergen, and the *Eira* in F. Josef Land, went through a night nearly as long as that of the *Alert* and *Discovery*, and yet they remained free from scurvy, living in huts instead of ships, and using, of necessity, much more of animal food than the *Alert's* crew, among whom the diathesis was confirmed in their first winter. Therefore, I attribute but a minor position to exclusion of sunlight as a predisposing cause, acting chiefly by prolonging the period of abstinence from fresh game, and not by any direct etiolation, as some have supposed. (Appendix B.)

I have adverted to the opportunity afforded by the concurrence of this instance (1875-76) with that of the *Eira* yacht expedition in 1881-82, for deductions as to the causations and the preventives of scurvy. The *Alert's* history has presented some of the causations, while that of the *Eira* provides a very remarkable instance of freedom from scurvy; on which it must be observed that its continuance was through a single winter, of which there have been many instances in ships. It could not be predicated that the second winter would have been exempt from scurvy, although there have been illustrative examples, but not one of a third winter immunity.

The *Eira* left Scotland in June 1881, to follow up the discoveries made by the *Tegethoff* in 1872-4, and to search for the missing *Jeannette*. She was furnished with every Arctic luxury, and, after steaming for ten days through the ice, on the thirty-first day out Franz Josef Land was sighted, where she anchored in a bay. On the 21st August, when only

eight weeks and a half out, she got nipped between the ground ice and the sea-pack driven on it by a strong tide, and having been crushed below her water-mark, in two hours she sank, in eleven fathoms water, with only topmasts standing above the ice. Such provisions and stores as could be got out were landed on the ice until the hut for twenty-five persons was built. The storing of animal food for the winter was next attended to, so that by the end of October they had the carcasses of twenty-one bears and thirteen walruses, with 1,200 looms of the size of wild ducks. From the ship they took 1,000 lb. of flour, 400 lb. of bread, *one barrel of salted meat*, 1,000 lb. of preserved meat, 800 lb. of soup, tobacco enough to allow each man two ounces a week, 60 gallons of rum, a few cases of brandy and whiskey, some sherry, six dozen of champagne, plenty of preserved vegetables, and some small stores; *but they had no lime-juice.* It may be said that, on a land of desolation, they had a provender that had never before fallen to the lot, and perhaps never will again do so, of castaways on the ice, such as admitted of a varied diet—the best of all preservatives from scurvy. Through the winter there was not much of total darkness, with about four hours of twilight, and the moon was unseen but for ten days in each month, and she was above the horizon for some days before and after the full, as experienced in all Arctic voyages. They were exempt from the heavy sledge work which the *Alert's* crew went through before and after the total darkness, their only labour being expended in the capture of more bears and more walruses, of which the *Alert* having none around them to capture, points to the greater severity of the climate they endured. It is in no way strange that the *Eira* continued free through one winter from scurvy, and especially as they dwelt in a hut, from which the only change was into the free and open air. Having occupied these quarters ten months, they took to their boats on the 21st June 1882, well stored with preserved meats and soups, etc., and sailed eighty miles without seeing any ice. Then their hard labour commenced, in dragging their heavily-laden boats across the floes from lane to lane of water; and on the forty-second day, when they were off the Matoschkin Straits of N. Zembla, they were picked up, all in good health, by the *Hope* steamer, Captain Sir Allen Young, which had arrived that day in search of them, and carried them home in sixteen days, after an absence of one year, two months, and three days, always in good health.

I cannot but consider that, from this series of favourable

circumstances, a contrast, rather than a comparison, has to be drawn between the situations of the *Alert's* and *Eira's* people during their winter sojourn in the Arctic region.

A still stronger contrast may be adduced between the fate of the *Eira* and that of William Barentz and his crew of nineteen men, who, on the 15th May 1596, sailed from the Vlie in Holland to seek a N.E. passage. After many risks of crushing in the ice, they rounded the north cape of N. Zembla, from which they saw open water in the S.S.E., and, therefore, they anticipated complete success; but on the 15th July, after being fifty-eight days out, they were beset and carried away by the heavy currents that prevail there. Again they were crushed, till gaps appeared in the ship's sides and two cables were carried away.

On the 5th September, when about sixteen weeks without any fresh provisions, they abandoned their ship, taking with them a carpenter's tool chest, a mizzen sail for a roofing to the hut which they intended to construct of the drift-wood they saw on the beach, which they easily effected by the 2nd October; and there it stood, as left with its furniture, intact, until 1871, when it was discovered by Captain Carlsen, a Dane.

By the 25th, all the provisions were carried from the ship to the hut. On the 6th November the sun disappeared, and then also the bears migrated, of which some were shot up to that time, for they followed the men up to the door of their hut and besieged it; but foxes were in more plenty through the winter, and their flesh being much preferred to that of the bear, they were trapped for food. During the long, dark night they spent most of their time in their sleeping places, whilst their victuals were by degrees undergoing reductions. In the middle of February the first bear of the season was shot, giving them fresh food and oil to relight their lamps with, and after that others were obtained. While on short rations, the men became weak and sick, and Barentz himself had the scurvy, and made his dispositions for the worst. On the 14th June 1597, eighteen made sail in two boats with sledges, after a detention on N. Zembla of nine months and one week; and Barentz died on the sixth day at sea, on which also his confidential seaman expired. From time to time they had to disembark and sleep in their tents; occasionally they would shoot a bear or some wild-fowl, and get eggs for food, and they saw innumerable walruses on the floes. But their own victuals failed them, so that for some time they had naught but four ounces of bread with water daily; and on 7th July another sailor died of scurvy. All

were very scorbutic when they reached the Bay of St. Lawrence, in N. Zembla, on the 28th July, after six weeks and two days at sea. There they found growing a plant they call "bistort", which they ate by handfuls, and were restored to health in two days; and they obtained relief out of two Russian whalers. They arrived at Kola, in Russia, on the 2nd September, eleven weeks and a half after leaving their hut—since which three had died of scurvy—and one year, four months, eighteen days, since they had left Holland.

The disastrous voyage of Barentz of ancient date stands in juxtaposition to the most modern in those seas, in which both passed a winter with very different results as to scurvy. Barentz's resting-place was 200 miles south of that of the *Eira*. Both helped out their provisions with the flesh of bears, walruses, birds, and foxes; Barentz not obtaining bears in the dark season, as the *Eira* did. Barentz on Nova Zembla saw the tracks of reindeer and of elks, while the *Eira's* report makes no mention of them in F. Josef Land. On leaving their huts in the middle of June, Barentz's people spent eleven weeks and a half in getting to a civilised land; but the *Eira's* were only six weeks in obtaining relief on board a well-appointed steamer. It must be generally acknowledged that the conditions of the *Eira* were very superior to those of Barentz's people in their supply of food and quantity of fresh meat, as well as in the shortness of their journey across the ice to their relief-point; and it is recognisable that the *Eira's* were of active habits, while Barentz's crew were very indolent, during their winter seasons—a matter of much moment in the production of scurvy.

These instances lie far apart in time, and we are not without one, of which Spitzbergen was the scene, not very much after that of Barentz, in 1630. It is authenticated in the *Collections of Voyages* of Churchill, and of Harris, and in those edited by foreign authorities; and it proves that early in the reign of Charles I, eight men of a whaler, sent ashore to procure venison for the ship, were abandoned by their captain on the western shore of Spitzbergen, with no personal possession save the clothes they stood in, and firearms and ammunition, which they used to procure game; which, running short in the winter, they then subsisted for weeks on the fibrous fatty refuse (the greaves) from the boilers used for reducing whales' blubber in the past summer. At this station there were two Dutch wooden huts, a large cooperage, and a smaller shelter, which they demolished and rebuilt within the cooperage, and fitted it with a stove, in which

they burnt the staves of oil-casks and the wood in store. Of reindeer they had shot many for winter provender, and of their skins they made bedding and door curtains; of biscuit, alcohol, and of lemon-juice and vegetables they were destitute, also of sugar, coffee, tea, cocoa, and salt. Probably a worse position had never fallen to the lot of English seamen, but they survived it, without even the diversion from dwelling on their menaced fates afforded by books and games. Scurvy never appeared among them; and, on the return of the whalers in the spring, when they had gone through nine months of a life so wretched and miserable, they were found well, though weakened, requiring only a few days' rest on board to refit them for the arduous work in a whaler. The historian was one of them—Edward Pelham by name—who wrote succinctly his account of an adventure of thrilling interest, indicating that in Arctic regions, to dwell through the long night of winter, with scanty and revolting animal food as their only means of subsistence, the shelter of a roomy hut with a cased-in walk around it, is an antiscorbutic means of the highest importance—an instance that deserves never to be forgotten.

In summary of what I have read, I have to offer the following conclusions on the evidence adduced:—

1. That previous to Parry's second voyage in 1822-4, no ship's crew ever wintered near the Arctic regions without suffering scurvy in the first year.

2. That it has been proved by the second voyage of Parry; by Ross in 1829-33; by McClure in 1850-54; by McClintock in 1857-59, that, with lime-juice daily, ships on their own resources, with but little of fresh animal food, and no fresh vegetable food, may pass a second winter there without scurvy appearing in typical degree.

3. That after that period, whatever may have been the amount of animal food, with lime-juice, available, the systems of the crew will have become so predisposed to the scorbutic diathesis, that scurvy will break out severely; from excessive labour, as with McClintock; or from moral causes, as depression; by disappointments, acting as exciting causes, as with Ross and McClure; and famine, as with Franklin.

4. That heated dampness of the atmosphere in the inhabited parts of ships, which is increased by maintaining a so-called comfortable degree of warmth, without due regard to ventilation so as to produce a steady uniform change of air, is a very important exciting factor of the scorbutic diathesis, exemplified in Parry's second voyage, second winter; in McClure's third, and in Nares' first winter.

5. That a higher degree of resistance to the predisposing and exciting causes of scurvy than has ever been displayed among crews confined to their ships during Arctic winters, has been found to prevail in those instances where crews, or portions of crews, have lost the shelter of their ships, and have been compelled by dire necessity to take up their abodes in huts on the land, or even on ice floes drifting with the currents.

6. That this seems to be dependent on the superior atmospheric conditions, and on the greater proportion of fresh animal food which such castaways are compelled to procure, in order to maintain their lives.

7. That the amount of animal food obtainable in the Arctic regions being precarious at all times, and at its minimum in the dark weeks, such supplies should be supplementary to ship's rations at all times; and greater varieties of preserved vegetables should be given. Where so little of animal food is secured for the winter season, the daily rations of ship's victuals should be then increased, as, in most instances, "short allowance" has been found the precursor of scurvy. Every possible precaution should be taken against that privation, even to victualling exploring ships for three years, on an ordinary voyage of two years; and the practice of "savings of rations" should not be encouraged except when fresh animal food is abundant.

8. That a varied diet of good ship's provisions, with a fair amount of fresh meat of Arctic animals and their blood, is highly conducive to health in Arctic regions, as shown in the case of the *Eira*, where it was cooked or eaten raw, as in the American expeditions to Smith's Sound, and by the *Hansa's* crew a winter on the floes off E. Greenland, together with the free use of blubber of walruses and of seals.

9. That, as in tropical regions, so it is in Arctic regions necessary to the maintenance of the health of Europeans to assimilate their diet in some degree to that of the natives, more especially as regards the quantity and kinds of food taken, of which the indigenous kinds have shown very anti-scorbutic properties; although with some, when used in large quantities, it will often cause diarrhœa.

10. And lastly, that without these precautions, combined with sanitary ventilation of dry, moderately warm air, scurvy may appear in the first winter, and cannot be postponed after a second year spent in the regions of ice and of prolonged darkness in the winter seasons. But, I imagine that the grand desideratum of pure air drawn from outside the ship into a heating chamber, and distributed by fanners, is now

practicable; and that in the same way cool air might be employed to preserve very many carcasses fresh, in properly fitted meat chambers, such as are in use in ships bringing home cargoes of fresh meat.

In conclusion, Dr. Lind, whom I regard as the great authority on scurvy, adopted the maxim, "*Dies docet diem*", when overthrowing all the theories of his day with regard to scurvy in fleets, of which it was the grand bane. I am of opinion that his maxim is as applicable now as then. He contended for all those sanitary measures that proved so successful in the second voyage of Captain James Cook, viz., cleanliness and dryness by the ventilation of ships; abundance of pure water; refreshment, as often as compatible with duty, by free supplies of fresh meat and vegetables, and changes from ship to shore as often as the service on which employed would allow of; and the use of anti-scorbutics.

Since then experience has expanded quite as much as it had in his day since the days of Lancaster, who, in 1607, demonstrated on a large scale the use of lemon-juice as a preventive, and of change from ship to shore, with abundant animal food, as a remedy for scurvy; but, after Lind, it took about half a century to introduce his views in their fullest extent into the Navy. His knowledge and his experience of scurvy were derived from the records of it in the temperate and tropical zones; while those of our own age are expanded to include the wide domain of Polar ice. From 1820 to 1882, the fullest details are at our disposal for study, and they seem to me to demonstrate the conclusions I have now ventured to lay before the Society for discussion, viz., that we, assisted by modern science, should find means to apply to ships a method of ventilation adapted to the circumstances of cold regions, as has been done in very hot, and temperate, climates; and that the dietary, as well as the mode of living, in the Arctic regions should be approximated in some degree to those that maintain the natives of them in health, or at least free from the disease which has so frequently disabled the brave crews in our explorations by sea, viz., scurvy.

In corroboration of these views, based as they are on so many instances recorded in the general history of scurvy, the evidence of the *Eira* expedition, rendered by Dr. W. H. Neale, has lately come to hand. It gathers, compactly, facts of a first winter in the Arctic regions, that show that Europeans may retain good health there so long, provided that they enjoy pure, not over-heated damp, air, which is more practicable

in huts than on board ship; with a nutritious and varied diet containing much of the flesh of animals—terrestrial and marine—of which, as he states, the raw juices and the cooked blood would appear to possess highly antiscorbutic properties.

I am of opinion that evidence to these considerations has reached a point that will tell advantageously when preparing for future Arctic explorations.

Appendix A.

The narrative of the *Advance* is important in several respects. She was under-supplied in navy provisions with pemmican for her boat parties, and with lime-juice, to go where fresh animal food would be found only casually. The scurvy appeared badly in the first winter out, in 78 deg. 37 min. N. lat.; and in their second summer, their condition, as described by Dr. Kane, was that "of a set of scurvy-riddled, broken-down men on reduced provisions, and such as were unsuited to our condition." There was then before them every chance of being frozen up a second winter; and, therefore, to better the position of all, Dr. Kane consented to the departure of half the crew, in hope of their getting homeward.

Dr. Hayes, who took charge of the retreating party, states that when they left the *Advance* they were all in the same state of health and on the same provender; but the sledge party had better chances of obtaining fresh animal food by the hunt, or by barter with the natives they might meet with, so that they soon obtained seals' flesh and blubber, and a little bears' flesh, which always acted as a specific and a preventive. After the winter had set in, little progress having been made, they were forced to get back to their ship, and, in good health, they reached her, to find their forsaken shipmates—than whom they had been worse off for shelter and for ship's provisions—all sick with scurvy, although they had had some flesh of seals and walruses. Their sledge party had been absent from the 28th August to the 12th December without going very far away. Their vantages had been in more fresh meat and open air, and as soon as these were lost, every man of them was, within a few weeks, stricken like the others with scurvy, although they had got rid of it while they were away.

Passing a second winter very badly, they deserted the *Advance* in May; and, attended by friendly Esquimaux, who fed them with the raw flesh of birds, they threw off their scurvy. Thus they reached the open sea in thirty days, and then, taking to their boats, got to Upernavick in fifty-three days more, or in eighty-three days from their ship. In these facts, we find the lesson of how they got and when they lost the scurvy, and in how much that had depended on being in the open air, since they suffered again as much as the others after their return. Again, on leaving the *Advance*, they were suffering badly from scurvy, with a possibility of still greater privations in store, but they happily procured seal-flesh. The latter part of their absence from the ship was spent in darkness.

The sledge parties of the *Discovery*, on the same coast, left their ship apparently in excellent health. They enjoyed continuous sunlight, but they had no fresh animal food, no vegetables nor lime-juice, and, after unparalleled muscular exertions, they broke down with scurvy, of which two died. The remainder reached their depôt of preserved meat, vegetables, and lime-juice at Thank God Harbour, where they procured seal-flesh and blubber, and speedily amended. The rest from labour they had there was as salutary to them as it had been to the *Advance's* sledge party in Whale Sound.

From these examples much is to be learned of the predisposing, existing, and aggravating cause of scurvy, and also much as to the circumstances under which its disappearance may be hoped for. On the one hand, defective or deficient nutriment and corrupted air, although the citrates may have been regularly taken, will predispose to, or, if long continued, will excite, the scurvy diathesis of the blood, which will readily fall into a dyscrasy of it, when new causes of debility, as prolonged labour and want of rest, are superadded. On the other hand, by an improved dietary to meet the demands of the system, and by rest from muscular fatigue, the sick may be expected to recover quickly, and perhaps more so if treated on shore, rather than between the confined decks of ships, with a less free access of unvitiated air, provided that fresh animal food is procured.

APPENDIX B.

TABLE *showing the reported absence of Sunlight in several Expeditions.*

Authority.	N. Lat.	Days of Darkness.	Supply of Fresh Animal Food.	Scurvy in first Winter or after it.
Nares	82.25	142	Unimportant	Scurvy, 1 case.
Stephenson	81.45	138	Important ...	Scurvy, 1 case.
Hall.....	81.38	125	Important ...	No scurvy.
Neale	79.58	123	Very good ...	No scurvy.*
Payer	79.43	123	Unimportant	Scurvy.
Kane	78.37	120	Unimportant	Scurvy.
Hayes	78.17	118	Abundant ...	No scurvy.
Pelham, 1630-1 ...	77.40	112	Very fair ...	No scurvy.*
Barentz, 1596-7 ..	76.30	97†	Unimportant	Scurvy badly.*
Koldeway	74.30	85	Important ...	Scurvy, 1 case.
Hegemann.....	74.30	Driftg.8.	Important ...	Scurvy, 1 case.
McClure	74.61	86	Important ...	No scurvy (2nd winter).
Parry (1st voy.)...	74.47	96	Unimportant	Scurvy.
Parry (3rd voy.)...	73.15	121	Unimportant	No scurvy.
McClure	72.45	8	Important ...	No scurvy (1st winter).
McClintock	72.	84	Unimportant	Scurvy (2nd winter).
Ross, John	70.	50	Important ...	No sc. (1st & 2nd wintr.)
Parry (2nd voy.)	69.10 Arctic circle.	4	Unimportant	Sc., mildly (2nd winter).
Parry (2nd voy.)	66.11	0	Unimportant	One case (1st winter).
Munk, 1609	66.11	0	None stated..	Scurvy, most destruc-
James, 1631	53.3	0	None stated..	Ditto.* [tive.*

Care has been taken in compilation, and yet there are apparent discrepancies in the number of days' absence of sun, relatively to the degree of latitude, which should fall in parallel gradations of increase—the higher the latitude, the longer duration of sun's absence. This defect in parallelism will arise from three causes: First, from fogginess of weather, for a few days at the disappearance or reappearance of the sun; secondly, from locality, where hills hide the southern horizon from view; and thirdly, from greater or less degree of atmospheric refraction.

In the first two instances the absence will be increased indefinitely, while in the third it will be decreased by only a day or two at the disappearance or at the reappearance of the

* Asterisks denote absence of lemon or lime-juice. The facts seem to indicate a very minor, if any, weight to absence of the sun's rays alone in the causation of scurvy.

† This is by calculation and time, but by ship's reckoning the absence was only of eighty-two days.

sun. But there must have been some very abnormal conditions prevailing when Parry noted 121 days of absence at 73 deg., while Kane noted, correctly, 120 days at 78½ deg. N. lat.

It is quite inexplicable that Barentz, who reckoned on an absence of ninety-seven days, found it to be only eighty-two days by calendar, the deficiency having been entirely in the proportion due to the period subsequent to the date of the sun's greatest declination—the 21st of December—the disappearance having taken place on the 2nd of November, and the reappearance on the 24th of January, giving forty-eight days' absence before, and thirty-four after, the 21st December —in all, eighty-three days; whereas there should have been forty-eight days after the mid-term, as there were preceding it. This can be traced to either of two reasons: First, to drifting southwards, which is impossible, as the winter was passed in a hut on shore; or, secondly, to error in calendar, from loss of time by timekeepers, which was repudiated by a statement that, on the night of the 24th of January, when the sun had reappeared, observations proved a conjunction of the planet Jupiter with the moon, in accordance with the nautical almanac. Loss of time, or of fifteen days' reckoning, must, however, have occurred to account for the anomaly of a solar phenomenon due on the 9th of February by calculation, which occurred by the ship's calendar on the 24th of January.

This need not be alluded to but for its bearing on the causations of the scurvy among the crew of Barentz, as the inference may be made of their having slept away the uncounted days. Pelham accused them of *indolence*, and consequent failure to make the best of their situation; and Barentz stated that in December they passed three days in bed because the chimney was choked with snow, and that they were for a long time deprived of light from the want of bears' fat to burn in the lamp; and he confesses that, in spite of all evils, they rarely cared to get out of the hut, but preferred to lie in bed in it; and it was not till the 15th of April that all of them paid a visit to their vessel, which they found to be as they had left her in November. For these reasons Pelham's final remark seems justified: "And then the world may see that the Dutch had the better provisions and we the abler bodies. If, therefore, the Dutchmen's deliverance were worthily accounted a wonder, ours can amount to little less than a miracle."

REMARKS ON THE EPIDEMIC OF CHOLERA IN EGYPT.

By Sir W. GUYER HUNTER, K.C.M.G., M.D., Surgeon-General Indian Army (Retired).

(*Read: January 9th*, 1884.)

Mr. President, and Gentlemen,—When, Sir, you did me the honour to invite me to read a paper having for its subject the late cholera epidemic in Egypt, I had some diffidence in responding to your request, as I felt that, after my report had been presented to Her Majesty's Government, anything that I might have to say would be robbed of much of its interest. On reconsideration, however, of the matter, there appeared to me one particular point in that report of such paramount importance that it could scarcely fail to prove of interest to this Society, even if much of the old ground were travelled over again. Having received, too, since the report was written, further corroborative testimony of my views on the origin of the epidemic in Egypt, I thought I might venture to place the matter before you. While this paper, therefore, has no pretensions to being a comprehensive one on the cholera outbreak of 1883 in Egypt, but will be strictly limited to an endeavour to explain the origin of the outbreak, yet it will not, I trust, fail in creating an interest among the members of the Society. If it does this, it will have served the purpose for which it was written.

Egypt is a very extensive country. It extends from the Mediterranean Sea to the Equator. It is not, however, this vast country which has been the scene of the recent epidemic of cholera, but rather Egypt proper, which includes the Delta and Upper Egypt as high as Assuan on the First Cataract. Its area of cultivated land is not larger than Belgium. Its population, however, according to the most recent census (1882), amounts to 6,798,280; and is consequently about one and a quarter million in excess of that of Belgium. The soil, which is very fertile, is an alluvium, "the gift of the Nile", and is rich in decomposing organic matter. The people are essentially agriculturists, and lead an outdoor life. Manufactories, though increasing, are comparatively few. It is almost a rainless country. At Alexandria, it is true, the

average annual rainfall for the last four years has been about eight inches; but in the interior, of which Cairo may be taken as representative, the rain is limited to a few showers, which fall during the cold months of the year—viz., in November, December, and January. The sky is generally cloudless, the air dry, and the dews very heavy. The prevailing winds are northerly, a southerly wind being quite exceptional. On looking over the meteorological reports, issued from the Khedivial Laboratory, one is struck by the almost tedious monotony with which the northerly winds blow throughout the year.

The rainfall being so scanty, the country is consequently dependent on the Nile for its water supply. The river is subject to periodical inundations, owing to the heavy rains in the equatorial region. The rise of the river at Cairo begins about the end of June, and is at its highest about the middle of September, when it gradually falls, until it again attains its minimum level in June. There being practically no rain, the subsoil water levels must necessarily follow the Nile level; that is to say, be at their lowest in June, and at their highest in September.

The larger majority of the people drink the water unfiltered, and generally before it has been allowed time to deposit. It is said that they prefer it in this condition. In Cairo the quality of the water supply is indifferent. At the waterworks there is but one settling tank, and, as it is in constant use, it can never be cleaned.

The large amount of mineral matter contained in the Nile water while settling carries down with it no inconsiderable quantity of the organic substances held in suspension in the water, and must lead to rapid fouling of the tank. Filtration is effected by gravel and sand. In the Ismailia quarter, that is, the fashionable part of the city, and in the Boulac quarter also, no attempt is made to filter the water, but it is supplied as obtained from the Nile. Close to the intakes of the Cairo waterworks, where some slight efforts, it is presumed, would be made to prevent pollution of the water, I have seen human and other animal excreta, fresh and stale, lying about in various directions, and men and women bathing, and washing their soiled clothes in the river. This was by no means an uncommon sight. The water supplied to Alexandria is, on the contrary, of very good quality. The system, though much the same as in use at Cairo, is carried out in a much more efficient and thorough manner. Alexandria is the only town in Egypt which possesses a wholesome supply of water. The river and the soil have been polluted through count-

less generations, and the alluvium is almost as absorbent as a sponge. Wherever there is water, it is scarcely too much to say, you may feel assured it has been fouled by man. The river is, I may say, polluted and fouled almost from its source. It is the means by which filth, garbage, and dead animals of every description are disposed of. Every town and every village situated on its banks add their quota to the fouling of the stream, until at length, when it has reached its lowest level in June, it is found, as at Cairo and Damietta, to be undergoing putrefactive changes; to present under the microscope the character of pond-water rather than of a running stream, and to contain bacterioid organisms in considerable quantities.

For a detailed description, chemical and microscopic, of the character of the water at Cairo and Damietta, in June 1883, I would beg to refer the members of the Society to my second and third reports to Her Majesty's Government on the recent epidemic in Egypt. Mr. Ismalun, Director of the Khedivial Laboratory at Cairo, and Dr. Sonsino, in their report, state that after July 20th bacterioid bodies were no longer found in the water.

As a specimen of the quality of the water used by the villages in Egypt, I would, in passing, call attention to a report made to me by Mr. Honman, one of the twelve medical gentlemen sent to Egypt by Her Majesty's Government for service during the epidemic. This gentleman was in charge of Mehallet-el-Kibir, a town of about 28,000 inhabitants, situated to the north of Tanta, midway between the Rosetta and Damietta branches of the river. Mr. Honman states in his letter, dated August 30th, 1883: "The town has three mosques; the drain from one running through the town, quite open, and with three feet of filth at the bottom. This discharges itself into a pool of water at the back of the town, which is used by the people for domestic purposes, and as drinking water for their cattle. The other two mosques drain in a like manner into pools outside the town, and they also are used by cattle and for domestic purposes. The stench from these drains can be smelt all over the town."

During the past year, the water-ways were more than ordinarily polluted by carcasses of cattle, which had died of typhus, being thrown into them, in order to evade a tax of five francs per head for their burial, which the poverty-stricken fellaheen were quite unequal to pay. It is notorious that many of the fellaheen were reduced to such straits as to be forced to feed on the carcasses of cattle which had died in this way. The number of carcasses and portions of carcasses

in a far-advanced state of decomposition removed from the Damietta branch of the river amounted to upwards of 1,500, a number considerable in itself, but insignificant as compared with the thousands which must have been thrown into the river. The losses in cattle occasioned by the "epizootic" weighed heavily on the fellaheen, and reduced them to strange and curious expedients to till the soil.

The villages are collections of mud-hovels, in which, with the human family, reside all their domestic animals, as pigeons, fowls, asses, goats, and perhaps a camel. In no towns, so far as I know, are there public latrines, except those belonging to the mosques, which are quite inadequate to meet the wants of the people, who are driven to the streets, gullies, and open spaces for natural purposes. This remark applies equally to cities like Cairo and Alexandria.

I must here for a moment interrupt my narrative in order to pay a passing tribute to the valuable sanitary work effected by the Executive Commissions which the exigencies of the times called into existence at Cairo and Alexandria. Shortly after the epidemic ceased in the Delta, these Commissions were dissolved, with a result that might have been foreseen: grossly unsanitary conditions again became rife, and have justly called forth from Mr. Clifford Lloyd the severest reflections on the Health Inspector of Alexandria and the Conseil de Santé at Cairo.

In Cairo, the cesspit system exists, and is carried out in a very inefficient manner. Many of the pits are holes dug in the sand, which have never been emptied nor cleaned. More recently, in the better class of houses, the pits have been better constructed, but their being emptied depends much on "the caprice of the landlord, not of the tenant." The wooden carts employed for removal of the sewage are of the most primitive description, and numerically are quite insufficient for the purpose. Consequent on there being no break of connection, the house-pipe and the cesspits are in direct communication one with another.

In Alexandria, an attempt has been made to establish a sewerage system, but, as in most things Egyptian, a very defective one. In the first place, it is but partial; in the second, it possesses radical defects of construction, and the outlets, some twelve or more in number, pour their contents on to the beach, directly to windward of the city. The sewers are, moreover, unventilated, such ventilators as existed having been sealed up about five years previous to my visit in August last. The privies of the houses are in direct communication with the sewers.

I might point to numerous other unsanitary conditions, not in Alexandria and Cairo only, but in the country generally, but refrain from doing so for fear of wearying the members of the Society. It will be sufficient to say that grossly unsanitary conditions abound everywhere, and there can be little doubt that, from their Sanitary Department, the Egyptian Government have received but scant service. It is, to me, a source of much satisfaction to know that the Conseil de Santé has been abolished, to be, I trust, replaced by an executive which will not be neglectful of its duties to the country and the people. Under such conditions as I have above faintly endeavoured to describe, it is hardly matter of surprise that bowel-disorders should be very common and very fatal, and zymotic diseases very prevalent. Visit what hospital or village one may, one is struck by reports of the prevalence and fatality of diarrhœa, enteric fever, and other intestinal disorders. And that, under the head of diarrhœa, numerous deaths from cholera lie hidden, I shall proceed to show further on, from evidence supplied to me by others, as competent as myself to form an opinion on the subject. Registration of disease is notoriously defective in the smaller towns and villages of Egypt. It is generally not until after death, when it may perhaps be necessary to obtain a permit for burial, that any attempt is made to ascertain the cause of death, and even then, as a rule, it is as often guessed at as not. Although the system be highly defective, yet it must not be lost sight of that all the returns and reports agree on the prevalence and fatality of disorders of the bowels. Samanood and Shibin-el-Koom were two towns among others which I visited while in Egypt. At the former, from the 1st to the 30th June 1883, out of 40 deaths from all causes, 26 were from diarrhœa. At the latter, out of a total of 174 deaths in May, June, and July 1882, 93 were from diarrhœa; in May and June 1883, out of a total of 110, no fewer than 57 were from diarrhœa. In Cairo, where registration, though far from perfect, is more reliable than in the smaller towns and villages, the mortuary returns show a very high death-rate resulting from bowel disorders. The members will observe, from the mortuary tables of that city for 1881 and 1882, which are placed before them, that in the former year, out of a total death-rate of 14,579, or 39.67 per *mille*, there were 1,097 deaths from gastric and typhoid fever, or 7.5 per cent.; 1,889 from dysentery, or 12.9 per cent.; 1,902 from gastric catarrh, or 13$\frac{1}{3}$ per cent.; that in the latter year (1882), out of a total death-rate of 17,290, or 46.98 per *mille*, the death-rate from the same causes was 10 per cent., 13$\frac{2}{3}$ per

cent., and 15 per cent. respectively—a startling mortality as compared with a city like Bombay, for example, where the death-rate from all causes for 1881 amounted to 27.87 per *mille*, and from bowel complaints a rate of 2.59 per 1,000.

Typhus fever is far from being uncommon, and in 1883, I have reason to believe, prevailed to some extent in the towns and villages of the Delta. In the returns for Cairo for the years 1881 and 1882, previously referred to, thirty-five and forty-six deaths respectively are registered from this cause. Little aid need be looked for from examination of the hospital-registers of the smaller towns and villages, as, in the majority of instances, the medical officers are incapable of differentiating between the typhus and the typhoid types of fever; and, under the latter heading, many examples of the former would not unlikely be found.

The recent war, too, not improbably exercised a certain influence in the general insalubrity of the country. Relatively, however, to other existing conditions, this influence could not have been considerable. The campaign was a very short one; its main operations were conducted in the desert—between Ismailieh and the Delta—outside, as it were, of the country. The men composing the "Indian Division of the Egyptian Expeditionary Force" were a picked body; and Deputy Surgeon-General Colvin Smith, C.B., principal medical officer with the force, in his report of the expedition, states that the fighting men and followers were "remarkably healthy"; that it was not until they had been resident in Cairo that their health began to suffer from diseases common to the country, as diarrhœa and enteric fever, both of which diseases he seems to regard as endemic in that city. From diarrhœa, he states, almost every officer suffered while at Cairo, and some very severely.

There have been in Egypt, since 1831, no fewer than five epidemics of cholera, exclusive of that of 1883. The first broke out in July 1831; the second on June 24th, 1848; the third on July 25th, 1850; the fourth on June 24th, 1855; the fifth on June 11th, 1865. The last, according to official reports, claimed 61,192 victims—a number, I imagine, much understated, unless registration was more efficient then than it was during the last year.

I am, I regret to say, unable to give the loss in population caused by the recent epidemic, as the returns have not yet been made up. The authorities are waiting until the disease has, I presume, ceased to exist. Now, however, that public attention has been directed to the matter, I fear some considerable time must elapse ere the report be published. The

disease clings to the country—*hæret lateri letalis arundo*—even as in years gone by; but its presence now is recognised and acknowledged—a marked advance in sanitary politics in Egypt, and, it is to be hoped, of good augury for the future. Better far an open enemy, whose attacks can be met, than a hidden foe, who, invisible, deals his death-blows with an unsparing hand, and creates a wail through the length and breadth of the land.

Having thus, gentlemen, however imperfectly, and in as concise a manner as possible, endeavoured to lay before you the chief physical features of the country, its grossly unsanitary conditions, and its more prevalent diseases, I think it will be admitted that never was a country more ripe for an outbreak of epidemic disease, such as cholera, than Egypt; and yet Egypt itself was apparently astounded when it was announced that cholera, or plague, had broken out at Damietta on June 22nd, 1883. Immediately the report reached Cairo, a Commission was deputed to investigate the matter. The Commission arrived at Damietta on June 24th, and reported that the disease was cholera, but found it impossible to come to any conclusion as to its genesis. "La Commission se trouve dans l'impossibilité d'établir la genèse du cholera epidémique de Damietta."

Dr. Flood, Physician to the Hospital at Port Said, believed (Drs. Chaffey Bey and Ferrari state in their report, to be referred to presently) that he had found the key to the enigma, and reported on July 5th to Salim Pasha, the President of the Conseil de Santé, that the disease had been imported by Mohamed Halifa, a stoker belonging to the *Timor*. This statement of Dr. Flood's has justly come to be looked on as incorrect, and, shortly after it was put forward, was effectually disposed of in a telegram from Sir E. Malet to Her Majesty's Government, dated Cairo, July 11th, 1883, which was as follows:—

"Mohamed Halifa, for some years inhabitant of Port Said, shipped as fireman on board steamer *Timor*. Made voyage to Bombay, returning 18th ultimo; all on board in perfect health. Obtained discharge at Port Said, and commenced course of drunkenness and excess. This continued four days, when he was imprisoned by governor of Port Said, and finally expelled by that official on 23rd ultimo, and arrived at Damietta on 24th, when he recommenced same course of excess on 25th. He is now at liberty, and apparently in perfect health. This disposes of theory, as epidemic broke out at Damietta on 22nd."

The next inquiry into the origin of the epidemic was car-

ON MED.
DEC 26
LIBRARY

ried out, under the instructions of the Quarantine Board, by Dr. Ahmet Chaffey Bey and Dr. Salvatore Ferrari; they are both medical officers of experience and of high standing in their profession. Their report is dated Damietta, July 24th, 1883, and will be found, *in extenso*, in my second report to Her Majesty's Government. These two gentlemen, firmly convinced of the importation of the disease, expected to obtain a confirmation of their views. Instead of this, after careful and patient investigation, they were forced to the conclusion that the disease had not been imported, and that there existed, in the deplorable unsanitary condition of Damietta itself, sufficient cause, in their opinion, for the origin and development of the disease.

Its importation into the country has also, I believe, been assigned to the Indian contingent during the war. I have, however, never yet seen this hypothesis formulated. This absurd opinion would seem to have had its origin in the representation made by M. Fauvel Inspector-General of Sanitary Services under the French Government, of the danger which he conceived would arise to the French troops, which it was then expected would be sent to Egypt, from their association with the troops coming from India. As the contingency happily never occurred, it is not possible to say whether M. Fauvel's doleful foreboding would have been realised or not. Whether this opinion of M. Fauvel's had been twisted to serve the purposes of those who believe in the importation of the disease into Egypt, I am scarcely prepared to say. Be that as it may, the subject has been allowed to drop.

The last importation theory which has been advanced is one by Dr. Mahé, delegate of the French Government, viz., that it has been introduced by coal-trimmers and stokers employed on board steamers running between Bombay and Port Said. The ingenuity and vagueness of this allegation will be at once apparent. The subject is being investigated by Her Majesty's Government. The inquiry is likely to be a protracted one; but that Dr. Mahé's views will share the fate of those which have preceded them, I, for one, cannot for a moment doubt. The necessity for any investigation seems to me doubtful, considering that conditions already existed in abundance in the country itself to account for the origin and diffusion of the epidemic, not in the Delta alone, but also in towns and villages in Upper Egypt, far removed from the line of traffic between Egypt and India. Dr. Couvidon, a French physician resident at Port Said, in a report addressed to the French consul, dated August 1st, 1883,

says it is not easy to determine the precise motives, either individual or general, which attribute the epidemic to importation. Be that as it may, the fact remains that nameless Bombay merchants and phantom-ships full of merchandise, have been conjured up, and are said to have brought the cholera from India to Damietta direct, without leaving any trace behind them at Suez and Zagazig: "I affirm and I prove that the present epidemic cannot have been imported." In the preface to his report, Dr. Couvidon says he bases his opinion on numerous thoughtful observations made during eighteen years' residence at Port Said.

A writer in the *British Medical Journal* of August 11th, 1883, states:—

"Moreover, cholera has never been shown to have been imported from the Indies to Egypt, or to Europe. It is not, of course, denied that cholera occurs on board ship; but the tendency is to its spontaneous disappearance during a voyage. As the Sanitary Commissioner with the Government of India has remarked, that since 1865 Egypt has not suffered once until now; Aden, which is still nearer to India, has never suffered to any extent. Only twice since 1865 has there been a slight outbreak there.

"But cholera has prevailed in different parts of Europe in ten different years since 1865. It is endemic in parts of the Russian Empire, yet no alarm is expressed by other countries.

"The English sailing vessels, the *Persia* and the *North Wind*, are often loosely quoted as having introduced cholera from the Indies into Jeddah in 1865. They sailed from Singapore with Javanese pilgrims, touching at Alepe on the Malabar coast, and at Makallah on the southern coast of Arabia, and arrived at Jeddah. The voyage in one case was about fifty days, and in the other about eighty. There was no cholera among the pilgrims until the vessels were anchored at Makallah, where new passengers were shipped. Cholera was prevalent during the early part of the year in various towns on the Hadramaut coast, and it is reasonable to suppose that Jeddah became infected by the cholera creeping along the land. But in no case can the disease be proved to have been imported from India; and, in every alleged instance of such importation, the allegation has failed to bear examination."

Further, on examination of the returns of cholera for Bombay, it is shown that during 1882 a total of 192 deaths occurred, as against 529 in 1881; and that 120 deaths were registered during the first six months of the present year. Consequently, Bombay, against which complaint has been

chiefly made, had been, during the eighteen months preceding the epidemic in Egypt, more free from cholera than usual.

Being of those who do not believe in the contagiousness of cholera, and who, therefore, do not look for a specific entity or germ, and its importation into a country, to account for the development and spread of the disease, I turned my attention to the country itself in search for a cause of the epidemic outbreak, and, after careful and cautious inquiry, came to the conclusion that the epidemic of 1883 was the outcome of the disease which existed endemically in the country. The evidence in support of this statement I shall now proceed to lay before the members of this Society. Previously to going on a tour of inspection into the Delta, it was intimated to me that cases of cholera had occurred in a Greek school at Damietta before the outbreak on June 22nd. On arrival at Damietta, I tested the truth of this statement, and came across the following cases.

1. Two Coptic priests (named Sadarros Yusuf and Gergis Hanna), after being carefully interrogated, informed me that a Coptic boy, named Hanna Gergis, aged five years, belonging to their school, had died of all the symptoms of cholera on June 17th.

2. A Greek priest, Michael Herodiades, whose statement was corroborated by the deacon at the Greek school, said that last May one of their scholars, Anton Nicolaïdes, aged eight years, was attacked at Damietta with excessive vomiting and prostration, but had no purging. The priest could give no details as to the suppression of urine. The lad was taken by his mother to Mansourah, where he died in twenty-four hours.

At Shirbeen I accidentally met with Dr. Dutrieux, a medical practitioner of Alexandria, who was employed by His Excellency Shereef Pasha in making inquiries into the cause and origin of the epidemic, and, on discussing the question, I discovered that his investigations had led him to conclusions similar to my own.

Shortly after my return to Cairo, I received the following telegram from him, dated the 13th instant:—"I have been to Feraskor to get serious information as to date of cholera at Damietta; returned to Damietta expressly to verify. Have received declarations in five cases. Two Greek children died April 27th; one day's illness, cyanosis, aphony, algid state, no vomiting, no diarrhœa. Another Greek child, ill about six months; vomit, cramps, aphony, algid state, without diarrhœa; death after six days. Arab barber, ill two or three days, towards end of April; died after vomit and diarrhœa. Arab shopkeeper, dead after twenty-four hours' vomit and diarrhœa. These facts are positive.—DUTRIEUX."

On my return to Cairo from tour of inspection, Dr. Sonsino informed me that he had received a letter from Dr. Ambron, who was then absent in Italy, in which he drew attention to a case of cholera which had come under his observation in Cairo. Dr. Ambron stated: "I am not quite sure of the year, but I believe it was in 1867 that I saw a case in the person of Dr. Giovanni Martini, who, being called out at night to an accouchement, wrapped himself up in a woollen scarf, which he said he had used only during the epidemic of 1865. A few hours later he was seized with fainting, then with vomiting and diarrhœa, and had all the phenomena of cholera, with the algid state and aphony, but recovered."

Dr. Sonsino supplied me with the following instances which he had met with in his practice in Cairo: "Tomaso Bonassi, of Leghorn, lapidary, was seized with cholerine on May 13th, 1873, and suffered from diarrhœa, vomit, algid state, and sunkenness of the eye cavities. He recovered after twenty hours. In November 1874, the same man, while an invalid from an abscess in the abdominal wall, was again attacked with cholerine, much more severely than the first time, but recovered, and is now in good health."

Dr. Rabitsch, in a memorandum dated Cairo, September 19th, 1883, states that "on a summer afternoon in the year 1878 or 1879, he was called hastily to a patient in the Hôtel du Mercure, and found there a man whom he pronounced to be suffering from cholera; there being no epidemic in the country, he stated that there was no fear either for the patient or for the persons present; the patient recovered."

Dr. Fouquet, in a letter addressed to Mr. Albert Ismalun, Director of the Meteorological Khedivial Laboratory at Cairo, states that "he had under his observation in September 1881, a very grave case of cholera nostras, which closely resembled Asiatic cholera; the patient recovered."

Dr. Sierra, a medical officer of the European Hospital at Alexandria, in a letter to Dr. Sonsino, dated Alexandria, July 31st, 1883, says:—"I have no written notes wherefrom to answer your question; I must trust to my memory; but I am sure that what I remember and shall tell you, I remember well. After the small epidemic of 1866, I sometimes saw cases of cholerine in Alexandria. I do not remember having attended to such cases all through the year, but I certainly saw some during the summer. During summer, and especially in the season of water-melons and fruit, it is common enough to have cases of gastric disorder; pains in the stomach, diarrhœa, and vomiting have always been very frequent in that season, and especially among the lower orders; but I

do not call this cholerine. By cholerine, I mean a copious vomiting and diarrhœa, accompanied by a marked fall in the pulse, agitation, sinking of the eyes. Without, however, being able to fix the exact date, I remember having seen a Jewess with these symptoms, where they lasted more than eighteen hours, and where the reaction was very difficult to bring about. I also remember that when I had such a case in my practice, and mentioned it to a colleague, I was told that similar cases had occurred in the town; but never more than two or three cases in a year. I never saw any cases of sporadic cholera—cholera nostras. I have lately questioned some doctors of the town, and have been told that a few congeneric cases have been noted by them also. In the European hospital, two cases were admitted in May, which the sisters told me showed choleraic symptoms. One of these died, the other was cured; he is now in the hospital with other ailments. These are the facts which have come under my observation."

When visiting the European Hospital at Alexandria, I had the satisfaction of meeting Dr. Sierra, and he very kindly placed me in the way of obtaining the required information, and subsequently furnished me with the details of the cases.

One case was admitted, under Professor Fougeron, on June 5th, 1882, and recovered; the other case, under the care of Professor Courtier, on April 17th, 1883, and ended fatally.

These cases are designated as "choleriform". Dr. Mackie has, however, to my thinking, more correctly described them as two typical cases of cholera. Dr. Mackie, at my suggestion, kindly made further inquiries, and obtained from several medical gentlemen, practising in Alexandria, statements of cases which had come under their personal observation. To Dr. Mackie, himself, I am indebted for notes of four cases which fell under his own observation. Two in the summer of 1881; another in the summer of 1872, which ended fatally; a fourth in the summer of 1872 or 1873, in one of the sisters of the Deaconesses' Hospital.

Dr. Kartulis furnishes a suspicious case as having occurred in September 1881.

Dr. Mamlouk, in his letter dated August 27th, 1883, mentions two cases—one of a suspicious character, which had occurred about eight years previously; another, a typical case of cholera, about four years previously.

Dr. De Castro, in his letter to Dr. Mackie, dated September 5th, states that in 1866 he observed several cases of cholera, which he considered as a residue of the epidemic of

the previous year; and he observed that new comers were more susceptible than the residents. Six or seven years ago he saw a case which recovered. About three years previously a case came under his observation and recovered. This patient had had a former attack in 1865. The second attack resembled the first, and presented all the phenomena of cholera. Another case he had under his care two years previously, in a woman who had arrived the preceding day from Naples; it ended fatally. Another case occurred in September 1882, in the captain of a ship recently arrived from Italy.

Dr. De Castro considers these to be cases of sporadic cholera, of which similar examples may be seen in the large towns of Europe; that they resemble cases of Indian cholera, but differ from them in being less grave, less fatal, and by their non-tendency to propagate themselves even in the absence of all sanitary precautions.

Dr. Demech states in his letter, dated Alexandria, September 3rd, 1883, that there had been an outbreak of cholera in Upper Egypt, which came from the Soudan, through Dongola and Wady Halfa, reaching Korosko in November 1872. He states that, since 1865, not a summer passed without his seeing one or two cases, more or less severe, of cholera nostras, but in 1866 he had two fatal cases in Europeans in Mansourah.

This concludes the information I obtained on this highly important subject from medical practitioners in Alexandria. On my return to Cairo, and since my arrival in England, I have received further evidence bearing on this matter.

Dr. Fouquet, in a letter addressed to Mr. Albert Ismalun, Director of the Meteorological Observatory at Cairo, which letter the latter gentleman has kindly forwarded me, states that he had under his observation, in September 1881, a very grave case of cholera nostras, which closely resembled Asiatic cholera. The patient recovered.

Dr. Haddad, in a highly interesting communication, dated Assiout, September 5th, 1883, which he has favoured me with, shows that diarrhœa has been a frequent disease for many years past. He adds that Dr. Mazurakis, in December 1882, had a patient who died with symptoms of vomiting, purging, cramps, and collapse, after ten or twelve hours. He states that diarrhœa has been a very frequent disease every summer, and that the Government registers show the mortality from this disease to be very great, being as much as one-third of the mortality from all other diseases combined.

At Assiout, Dr. Haddad states that a man who arrived from Cairo on July 28th, when the epidemic was at its height, and who died of cholera the following day, was entered in the Government registers under the head of "Choleriform". The inhabitants of Assiout "laughed" at this being considered the first case of cholera which had occurred there. The presence of cholera in Assiout is not recognised in the Government register until July 31st, when two cases are recorded. Further, Dr. Haddad gives it as his opinion that cholera was not imported from Lower Egypt, even supposing importation ever occurred. He concludes by saying:—"How many years it has existed here I cannot say, as I have neither the means nor the time to institute proper inquiries." I had arranged with Dr. Haddad to investigate this matter, but, as I was leaving the country, I deemed it unadvisable to allow him to do so. Dr. Haddad, being an able man, and a cautious and careful observer, and possessing a thorough knowledge of Arabic, was eminently qualified for such work.

If the report of Dr. Haddad be considered side by side with the letter from Dr. Demech and the statement of M. Chevalier to Surgeon-Major McNally—"that cholera had existed in the Fayoum (Upper Egypt) six years ago"—I think it will be admitted that there are some grounds for the belief that cholera has existed in Upper Egypt since 1872.

I have next to draw attention to a letter from Dr. Patterson, Her Majesty's Consular Surgeon, Constantinople, dated Constantinople, September 24th, 1883, in which he states that he practised for thirteen years in Egypt, from 1855 to 1868, both in Cairo and Alexandria. Dr. Patterson states that he was well acquainted with the large districts between Kafr and Zayat and Suez, and also the districts of Mansourah, Zagazig, and other places where cholera has recently prevailed. He affirms that he cannot recall a year during that time without several well-marked cases of cholera having come under his notice, and which were conveniently classed under the head of "Cholera Nostras".

Further on, he says that no one acquainted with the disease could doubt that cholera—by whatever name it might be designated—was endemic in Egypt. Again, he says:—"Every year, at that time, there was a cholera-panic, and not without reason; and we seemed yearly to be on the eve of a cholera-epidemic; yet no one thought of attributing it to an Asiatic or Indian origin, and there was no proof that the disease was infectious."

I requested the staff of medical officers employed in Egypt to institute inquiries as to the existence of diarrhœa and

cholera in the districts where they were stationed, antecedent to the officially declared outbreak on June 22nd at Damietta, and to report the results to me. Owing to the rapid decline of the epidemic, the Egyptian Government no longer found it necessary to retain the services of these gentlemen, and consequently but little time was given them to make the necessary inquiries. I have, however, received from some of them valuable information, more especially from Surgeon-Major McNally, Madras Medical Service, in charge of Zagazig and district; and from Mr. Honman, in charge of Mahallet-el-Kebeer and district.

In a letter addressed to me, dated Cairo, September 1st, 1883, Surgeon-Major McNally shows that, in the villages in the neighbourhood of Zagazig, diarrhœa with vomiting had existed since the previous January, and had proved fatal to two hundred persons; that great mortality had taken place from cholera at Chibin-el-Kom prior to the report of its occurrence at Damietta; that, in certain villages in the neighbourhood of Benha, cholera had appeared before the reported outbreak at Damietta, and in one village the deaths were said to have numbered more than fifteen a day; and, finally, that M. Chevalier, an engineer, had informed him that he had known cholera to exist at Fayoum (Upper Egypt) six years ago, and also in other parts of Egypt during past years.

The existence of cholera was not officially recognised in Mahallet-el-Kebeer until July 16th, when three deaths were reported; and yet Mr. Honman, in his letter, dated Mahallet Kebera, August 30th, states that numerous cases of cholera had occurred in Mahallet before that date; that diarrhœa was a common complaint in the town, and that for a month before the outbreak the cases had been most severe and intractable; that at Miniett-el-Samanoud and other villages there had been an epidemic in the month of May, as many as four a day dying out of a population of 4,000; that the deaths had been registered under the head of "Diarrhœa", and had been so numerous at Miniett that the Cadi of the town had forbidden the use of the drum at funerals, in order not to draw attention to the number of deaths; and that, although on one day there were twenty-nine deaths, the fear of a *cordon* caused the fact to be suppressed.

It will be observed that all the facts above noted were communicated by medical men as a result of their personal experience and personal observation, and all being men of position and standing in their profession.

Mr. McCullough, an Inspector in the Department of the

Minister of the Interior, while engaged at Menzaleh, near Damietta, in investigating a judicial case, states that he was convinced by overwhelming evidence that cholera had been raging in the island of Matariah, on Lake Menzaleh, a month before it broke out at Damietta.

The next and last piece of evidence which I have to bring forward in support of the above is that obtained from an official enjoying a high position under the Egyptian Government, who told Sir Evelyn Baring, "We all know that cholera has been constant here, and generally follows the cattle plague; but we are told to say nothing about it."

The documents from which the above abstracts are taken will be found in my second and third reports to Her Majesty's Government. A careful consideration of the facts satisfactorily proves that cholera has existed in Egypt in an endemic form since the epidemic of 1865, and probably anterior to that period, as shown by Dr. Patterson. The epidemic of 1883 was consequently the outcome of the disease which existed endemically in the country.

Dr. Dutrieux's conclusion that cholera centres existed long before June 22nd (date of outbreak at Damietta), in several places in Lower Egypt, is confirmed by the data furnished by Surgeon-Major McNally and by Mr. Honman.

The evidence, considerable as it is, was collected in a few weeks. Had longer time been at my disposal, I believe it might have been materially added to. There is one significant feature as to the sources of my information. It was all, or rather nearly all, obtained from medical men not in the employ of the Egyptian Government. The inference consequently is, that either the Government medical officers had failed to recognise the disease, or else that they maintained a strict silence on the matter. This inference may be considered a harsh one. The time has arrived, however, when it is essential that all that bears on the origin of the late epidemic should be put plainly. It has been shrouded so long by collateral and incidental considerations, that I feel I should ill represent what I believe to be the facts by obscurity of language.

Cholera is recognised by a certain group of symptoms; and it is merely begging the question to say that a particular case coming under observation, though presenting all the phenomena of cholera, cannot be cholera, because there is no evidence of importation, and that it "does not propagate itself in the absence of all hygienic precautions." (See Dr. De Castro's letter in my final report to Government.)

Dr. De Castro, the delegate of the Italian Government, is

an able and experienced officer, and is, moreover, a representative man. I have a great respect for his opinion, but I regret that I am unable to accept his conclusions. I presume Dr. De Castro would not refuse to accept the evidence afforded by certain symptoms, which indicated that he had before him a case of pneumonia, and no other disease, because he could not trace its cause, and then proceed to designate it by some other name; nor would he, after witnessing inoculation by small-pox virus, proceed to pronounce the resulting phenomena not those of small-pox, because the disease did not propagate itself.

Inoculation was formerly practised to a large extent in Lower Bengal and other parts of India, but is now happily being rapidly displaced by vaccination. Frequently years would elapse without the disease spreading among the community. Would it be fair to argue from this that the phenomena resulting from the inoculation-process were not those of small-pox, because they did not propagate themselves? A terrible awakening would probably await those who held such opinions, in the shape of an epidemic outbreak that would decimate the population. Here I am speaking of a disease the contagion of which is recognised as being perhaps the most virulent known; whereas cholera, in my opinion and in that of many others, is a non-contagious disease, and consequently not likely to spread from individual to individual, as Dr. De Castro evidently expects it to do.

The cause of the spread of cholera and diseases of the zymotic type depends on certain epidemiological laws not yet well understood, but which I shall have occasion to refer to further on.

In the nomenclature of disease in India, the term "cholera" is only permitted to be used when speaking of the existence of a certain group of symptoms; when these are recognised, the official return is "Cholera". Choleraic diarrhœa has, for good and sufficient reasons, for some years past been struck out of the returns. Were the same rule applied to Egypt in the registration of disease, much confusion would be avoided, and such terms as "cholerine", "cholera nostras", "choleriform", etc., applied to modified forms of cholera, cease to exist.

If the cases communicated in many of the attached documents be not cases of true cholera, but rather of cholerine and cholera nostras, then Bombay ought no longer to be regarded as the seat of endemic cholera; for the majority of the cases I have seen there, during intervals of epidemic

activity, were cases of so-called "cholerine", "cholera nostras", etc., and they did not propagate themselves. These several forms of the disease differ in no essential particular, either clinically or pathologically, from one another, and therefore ought to be registered as cholera.

Dr De Castro also states, in his letter, that if the cases which had come under his observation were cases of cholera, then cholera existed in many of the large cities of Europe. Here I agree with him, for I feel little doubt that examples of cholera are of not unfrequent occurrence in many of the cities and towns of Europe, not excluding the British Isles. In certain parts of the Russian empire, cholera is affirmed to be endemic.

I shall next consider certain meteorological states which existed during the outbreak and preceded it. Before doing so, however, it will be interesting to refer to like phenomena which have been frequently observed, not in India only, but also in Europe, in connection with cholera.

Mr. Glaisher, in his Report on the Meteorology of London during the three cholera epidemics of 1853-4, of 1832, and of 1848-49, says:—"The three epidemics were attended with a particular state of atmosphere, characterised by a prevalent mist, thin in high places, dense in low. During the height of the epidemic, in all cases the reading of the barometer was remarkably high and the atmosphere thick. In 1849 and 1854 the temperature was above its average, and a stillness of air, amounting almost to calm, accompanied the progress on each occasion. In places near the river the night temperatures were high, with small diurnal range, a dense torpid mist, and air charged with many impurities, a deficiency of electricity, and, as shown in 1854, a total absence of ozone, most probably destroyed by the decomposition of the organic matter with which the air, in these situations, is strongly charged."

Without entering into details, I may say that, in India, outbreaks of cholera are usually found associated with high temperature and a moist, stagnant atmosphere, inducing much languor and depression and a stifled feeling; and the Punjab, with its dry climate and sparse rainfall, affords no exception to this rule.

Dr. Roche, in writing of the outbreak of cholera at Kotree, Scinde, in September 1862, which, as regards climate, is, perhaps, even drier than that of the Punjab, states the atmosphere to have been, during the month, unusually sultry, still, and moist, with a high temperature.

Mr. R. Borg, Her Majesty's Vice-Consul in Cairo, who has

devoted much of his time to sanitary matters, informed me that "when cholera was at its height in 1865 in the capital, the sky was lead-coloured, the atmosphere oppressive, so as to render breathing rather difficult at times; and the town of Cairo, as seen from the Mokattan Hills, seemed to be enveloped in a spherical cloud of thick mist during three consecutive days." He also observed that the sparrows deserted the towns, and did not return until the epidemic was on the decline. These observations have been verified by others.

Brigade-Surgeon McDowell, A.M.D., Sanitary Officer of the Cairo district, reports that when the epidemic was at its height on July 23rd, a very peculiar condition of the atmosphere was observed—a yellowness of the air, somewhat of the nature of a fog, and it was quite calm. The sparrows, it was noticed, had deserted the place, and did not return till July 26th. On the night of July 23rd the cholera first attacked the British garrison at Kasr-en-Nil, Abassieh, and the Citadel.

It is curious to note that the Arabic phrase for cholera is "the yellow air" (el-hawa-el-asfar), and that the fact of birds deserting a place at such periods has also been remarked by the natives.

Surgeon Prendergast, A.M.D., informs me that on the day of the outbreak of cholera among the British troops at Ramleh (August 3rd), there was a high temperature, the air approached saturation-point, the wind, which for many weeks before had blown as usual from the north, slowly dropped, the heat became intense, attended with a feeling of oppression. The ripples died off the sea, leaving it as glassy as a quiet pool. The sky, usually studded with cirri, was cloudless. Now and then a faint breath of wind sprang up from the south-east, and as suddenly died away. Men who had served in India remarked that there was cholera in the air, and at 10.30 A.M. the first case was reported.

Another pertinent illustration is given by Dr. Kirker, R.N., of H.M.S. *Iris*, in his report of the recent cholera outbreak at Chatby. This village, of 2,000 inhabitants, though distant from Alexandria but a quarter of a mile, and in constant communication with it, had been free from the disease up to October 15th or 16th. Its sanitary condition was extremely bad. It is situated in a hollow, but it is open to the north and the influx of the sea-breeze. "On September 19th, the prevalence of the north-westerly winds was broken. Then followed a period of variable winds, the easterly and southerly ones being the most frequent. The rain on October 9th and 10th may be taken as marking the termination of this period

and the starting-point of another. In the second, from the night of the 10th to the night of the 15th October, the wind, which was always nearly light, varied from east to west only round by south." Frequently at night there was no wind at all, and the temperature rose from a maximum of 70 deg. on the 10th to 84 deg. on the 15th. "Now, I believe," continues Dr. Kirker, "that the stagnancy of the air over Chatby, owing much to its low and sheltered position, especially during the period from October 10th to 15th, forced the disease into existence, and that the influence of the motionless atmosphere was assisted by the rise in temperature and by the moisture of the ground following the rain on the 9th and 10th." . . . . "Again, the fact that the disease reappeared in Alexandria at or near the time it more violently struck Chatby, points to a common exciting condition, such as the weather, and discredits the theories of mere local causation."

Dr. Kirker has, at my request, been good enough to forward me some instructive meteorological data made by him during last June and July, at Port Said, Alexandria, and Damietta. The chart for the month of June is the more important, as it was at that time that the epidemic broke out. His views are more definitely expressed in a letter addressed to the editor of the *Egyptian Gazette*, dated Port Said, July 28th, 1883, and published in that journal on August 1st. He states that the meteorological phenomena antecedent to, and during, the outbreak at Damietta, may be divided into two periods; during the former period (May 28th to June 23rd), the winds were variable, many of the nights were almost or quite still and cloudless; the humidity of the air being excessive, at one time, on June 12th, 13th, 14th, and 17th, being at saturation-point (100), the average varying from 91 to 92; and there was no rain. In the latter period, from June 23rd to July 6th, the relative humidity was only 78 and 82, at 9.30 A.M. and 11 P.M. On June 24th, the sea-breeze was established, the wind blew during the day from the north-west, veering round towards the south-west during the night and early morning, and there were no calms.

I am further indebted to Dr. Kirker for some very valuable and highly interesting meteorological summaries for the month of June from 1870 to 1883 inclusive, which I have the pleasure to place before the members of the Society. As the letter which accompanied the summaries would only lose in force by anything I might have to say, I shall allow Dr. Kirker to speak for himself. His letter, dated *Iris*, at Malta, December 6th, 1883, is as follows:—

"I have the honour to enclose you a copy of the meteoro-

logical summaries for the month of June, from 1870 to 1883 inclusive, which, by the kind permission of M. A. Pirona, I have made from the meteorological register of the Observatoire et Station Météorologique de l'Impérial et Royal Institut Central de Vienne, at Alexandria.

"1. My object in sending the enclosure is to furnish you with the means of comparing, as regards weather, last June —the month when the cholera became epidemic in Egypt— with the Junes of the previous thirteen years.

"It is seen that in 1883 the mean barometric pressure (758.2 millimètres=29.851 inches) was below the mean (758.7 millimètres=29.871 inches) of the fourteen years; and that the extreme variation (5.1 millimètres=0.200 inches) for the one year was less than the mean of the extremes (7.6 millimétres=0.300 inches) for the period.

"The mean temperature (24.4° C.=75.9° F.) in 1883 was only a little above the mean temperature (24.0° C.=75.2° F.) of the fourteen years.

"The mean relative humidity (71) in 1883 was less than the mean (73) for the fourteen years. The maximum relative humidity for the month is not shown in the summaries, but the tables of daily registration, which will be more particularly referred to afterwards, show that in 1883 it reached 96—the highest recorded in any month whatsoever since January 1876.

"The mean relative amount of ozone (6.4) in 1883 is 13.5 per cent. less than the mean (7.4) for the fourteen years. On examination of the summaries of the ten months, January to October, it is seen that the mean relative amount of ozone for that period in 1883 is less by 17.0 per cent. than the mean for the same period in the seven years 1875 to 1881. The ozone-observations do not extend further back than 1875, and the record for 1882 is incomplete.

"The mean wind-force for June 1883 is less than for any previous June for thirteen years. Again, the summaries of the ten months, January to October, show that the mean wind-force for that period, in 1883, is 36.8 per cent. less than the mean for the same period in the twelve years 1870 to 1881. Only in 1877 has this period as low a mean wind-force as in 1883.

"2. In one of my former communications, I pointed out that the nine days from the 12th to the 20th June last, was a period of excessive relative humidity, with occasional stagnancy of the air, especially at night. Now, M. Pirona has the monthly tables of daily registrations since 1876, and these show that the above period, as regards the combination

of great moisture of the air and low wind-force, is unique in the meteorological history, not only of the month of June, but of the entire years since 1876. There are only about two periods of equal length in which the mean wind-force was so low—one in January 1877, and another in December 1878; but in these periods the mean relative humidity and temperature were also low. There are several periods of greater mean relative humidity, though one of the highest maximums recorded occurs in the June 1883 period; but all of these had a much higher mean wind-force.

"3. In a report which I wrote on the outbreak of cholera at Chatby, Alexandria, I said: 'Now, I believe that the stagnancy of the air over Chatby, owing much to its low and sheltered position, especially during the period from the 10th to the 15th October, forced the disease into existence; and that the influence of the motionless atmosphere was probably assisted by the rise of temperature and by the moisture of the ground following the rain on the 9th and 10th.'

"In connection with the time here referred to, M. Pirona's summaries show nothing particular for October 1883. The daily registrations, however, show that then (10th to 15th October) a fall in the force of the wind, and a change in direction from northerly to southerly, took place. The only other October since 1876 in which a similar period occurred was that of 1877.

"In conclusion, I think it may be safely said, that M. Pirona's observations give weight to the opinion that this year meteorological conditions had a strong influence in the generation of the cholera-epidemic; for they show that the year 1883, particularly in the month of June, has differed even from its comparatively remote predecessors in the directions most favourable to disease."

The frequency with which atmospheric phenomena have been observed in connection with outbreaks of cholera leads to the conclusion that they stand in close relation one to the other. Whether that be as cause and effect, is perhaps hard to say. It is probable that it is to a combination of certain conditions of a cosmo-telluric character, of air, soil, and water (filth, as in Egypt, being a powerful factor), that the development of an epidemic is due. Given, as in Egypt, endemic centres, the peculiar atmospheric state noticed would probably act as an exciting cause in the immediate production of the epidemic outbreak.

ON THE ETIOLOGY AND PATHOLOGY OF CHOLERA.

By GEORGE GULLIVER, M.A., M.B.,
Assistant Physician to St. Thomas's, and the London Fever Hospital.

(*Read: March 12th*, 1884.)

Mr. President, and Gentlemen,—During the discussion of Sir Guyer Hunter's report on the recent epidemic of cholera in Egypt, there arose a question—which, as far as that report was concerned, was a side-issue—as to whether cholera is or is not contagious. Sir Guyer Hunter showed in his report that the statements which had been made in certain quarters as to cholera having been introduced into Egypt from India were groundless, and this he did in two ways; first, by entirely disposing of a specific charge against a certain individual as having been the importer of the disease; and, secondly, by showing that the assumption of the importation of the disease from India was unnecessary, seeing that, at a period long antecedent to the epidemic, the disease was endemic in the country, at any rate in the Delta. Consequently, the question of the manner of the spread of the disease was not dwelt upon as an essential part of the argument.

However, a matter of such importance for discussion having sprung up, and there being still many who might be anxious to bring forward their views on the subject, your Secretary did me the honour to convey to me the request of the President that I should reintroduce this matter of the etiology of cholera, without any special reference to Sir G. Hunter's report, except in so far as it may illustrate the subject in common with the rest of its literature. It was with considerable diffidence that I determined to come before you to-night, having but little practical experience of the subject; but I felt that such an opportunity for my own instruction was not to be neglected, and I have consequently ventured to place on paper some facts and inferences bearing on the question.

Before entering upon the question of the causation and

mode of spread of this disease, it will be well to consider those points in its pathology and clinical history about which there can be little room for divergence of opinion. In the first place, all are probably agreed in looking upon cholera as a *specific* disease, and few would be likely to cavil if we were to define it as a *specific febrile* disease. The symptoms and pathological appearances necessary to complete the definition are known to all, and it is unnecessary to enumerate them here.

Now, our knowledge of specific diseases generally brings before us constantly the fact that one or more of the most important symptoms may be absent, and the disease none the less specific or significant in its import. Thus we all know of the frequent occurrence of cases of scarlet fever in which the pathognomonic rash is absent, and of those cases of small-pox in which it never makes its appearance. We all know how insidiously the rheumatic poison may seize upon the endocardium, and the patient suffer never an ache nor pain, and but few are now found to maintain that the typical Hunterian chancre is a necessary precursor of general syphilitic infection. In studying diseases such as these, I venture to think that we gain as much, if not more, information from the cases which do not conform to the rule, as we do from those which do so in every particular. In the matter of their etiology, no one can doubt that we should be in a very much more backward state than we now are had our conclusions been based only upon the observation of cases in all respects running a typical course. The difficulties which beset an inquiry into the anomalous and slighter, or—if one may be allowed the expression—*latent* cases of cholera are obvious, and need not detain us. The importance of the subject is one which has not escaped the attention of observers, and we may hope at no distant period to see this branch of the subject much extended.

Meanwhile, however, in discussing the etiology of cholera, we are obliged to rely solely on typical cases for exact information, and this cannot be more forcibly brought to our minds than by noticing the manner in which Sir Guyer Hunter, in his report, has been at pains to get it substantiated that the cases which go to support his proposition, and which are attested by Dr. Mackie, Dr. Sonsino, and other physicians, presented *all* the symptoms of Asiatic cholera, *i.e.*, that they were typical cases of that disease.

Assuming, then, that cholera is a *specific* general disease, and bearing in mind that we know little, if anything, of its anomalous and slighter manifestations, we are in a position

to affirm with little or no hesitation that it depends upon a specific poison, and to discuss subsequently the mode of origin and propagation of this poison. We know that in certain general diseases the poison has its origin within the body itself, as in the case of gout, and with little doubt in that of rheumatism. On the other hand, in the case of scarlet fever, enteric fever, and that class of diseases which may be styled collectively malarial, the poison is absorbed into the system from without. None, I think, will be found to maintain that the poison of cholera belongs to that class which is engendered within the body itself, and the issue is consequently narrowed into considering its mode of origin and propagation without the healthy body, and its mode of entrance into the system. It will now be well briefly to enumerate the views held on this subject, without going into detail.

First, there is the view, which has found much support in Europe, that it is contagious, that is, transmissible from diseased man to healthy man. It is not necessary here to go into the various surmises which have arisen as to the method of its transmission. Secondly, there is the view, which has its advocates mainly in those whose experience is Indian, that it is not contagious—that it is an influence partly atmospheric and partly, perhaps, telluric, which constantly exists in certain localities, there rendering the disease endemic, and which, under certain conditions, spreads so that the disease becomes epidemic. Thirdly, there is that view, which has its advocates mainly in Germany, and which regards the poison as derived indeed primarily from man—that is, from man who is the subject of the specific disease—but which regards the soil as essential to the further propagation of the disease, acting, as it were, as an intermediary host, in which the poison undergoes certain changes prior to the possibility of its reabsorption and development in the body of man. This view is in some way a reconcilement of those which have preceded it. Fourthly, and lastly, there are certain views not so definite as the foregoing, and which endeavour to reconcile them where they conflict in a manner which does not seem altogether admissible by sound reasoning. Such are the views hinted at or expressed by some, that the mode of propagation is different in Europe from that which obtains in India, or that even in India alone the disease is at times contagious, but not propagated in that manner as a rule.

There are, I am aware, many other views on this all-important subject, but they are for the most part, it would

seem, adaptations of or different modes of expressing some of the foregoing.

Before proceeding to discuss these various views, it will be well to bear in mind one great and striking fact which meets us constantly in studying the etiology of cholera, and that is the overwhelming importance of those causes which come under the heads of *predisposing* and *exciting*. When a person debilitated by disease, want, or excess, or suffering from catarrhal affection of the bowel, comes within the sphere of influence of the cholera poison, we say that he is predisposed to take the disease, and consequently runs a fearful risk. Again, a person usually enjoying good health is resident in a locality where cholera is prevalent. He suffers from some temporary malaise, to remove which he takes, either of his own accord or by the advice of some injudicious friend, a dose of Eno's fruit salt, Epsom salts, or some other purgative, and is shortly afterwards attacked by cholera. We can have but little doubt but that the purgative which he has taken has been the exciting cause of the attack, and that but for this he might have remained free from the disease. So great and important is the *rôle* played by these predisposing and exciting causes in determining the onset of cholera, that I doubt if there is a parallel in the history of the etiology of those specific diseases in which the poison is absorbed from without. So great and obvious is their influence, that at times we are almost in danger of confounding them with the immediate cause, the cholera poison itself.

Considered with reference to this, a comparison with what takes place in the case of gout may not be devoid of instruction, though I am aware that the analogy is not a real one. A man inherits the gout, which may lie dormant in his system throughout his life, the poison being present in him for all that, and transmissible to his children. Such a man commits an excess, or series of excesses, the excess being either physical, or mental, as when he suffers from great anxiety or anger. The poison which is latent within him is roused into activity, and his enemy seizes him without warning and suddenly. So with cholera. A person living within the cholera area has the poison, not indeed in his blood, but it is everywhere in his surroundings. He, too, commits an excess, or series of excesses, the excess being either physical, or mental, as when he suffers from excessive fear. The poison which is around him seizes him without warning and suddenly.

So much for the predisposing causes of cholera. There can be but little fear, with the evidence which we have

before us, of our underrating their importance, and we must avoid confusing them with the immediate cause to which we now revert, namely, the cholera poison. The examination of the first proposition now engages our attention. What evidence, then, have we to support the proposition that cholera is communicable from man to man?—what evidence derived from observation, from experiment, or from comparative pathology? Of late years, those lower forms of life, bacteria and the like, which are found associated with certain specific diseases, and which are, in some cases, almost beyond the shadow of a doubt, the causes of such diseases, have engaged much attention. Quite recently, as we all know, the search for some specific form associated with cholera has been pursued with vigour. The German observers, amongst a multitude of such forms, have found one which appears to be constant in its occurrence in cholera, whilst it is absent in other diseases. With the exception of the spirillum of relapsing fever and the behaviour with re-agents of the bacillus of tubercle, we know too little at present of the form and characteristics of such bodies to warrant our giving much weight to form alone as entitling them to specific distinction, and we must await further inquiries before speaking definitely on this point. The disease does not appear in any way to be communicable from man to the lower animals, and it may frankly be conceded that up to the present time we have no certain knowledge of any bacillus or germ which can be regarded as the cholera poison. I do not know that at the present time anyone is intently engaged in searching for, or much agitated about the failure to find, an organism which can be regarded as the germ of enteric fever. As in the case of cholera, inoculation of the lower animals has produced results only negative. Why, then, have we drifted into this condition of apathy on this subject? It is because, thanks to unsanitary conditions, we have had done for us a vast series of experiments on human beings, which prove beyond a shadow of a doubt that the poison is nurtured and multiplied in the body of the diseased man, and is cast off from his body in the fæces, with which, owing to unsanitary conditions, it is taken into the bodies of other and healthy men, where it takes root and multiplies.

Now, have we any evidence of this nature in the case of cholera? Beyond a doubt we have evidence, and that of the strongest character. I must ask you to pardon me whilst I tell an oft-told tale, in recalling to your minds a few of the more remarkable instances which point to the communicability of cholera, for I venture to affirm at this juncture that

in a matter of this nature one positive case is worth twenty negative. Let us go back, then, to the year 1865. In that year there lived, in the small village of Theydon Bois in Essex, a certain farmer named Groombridge. His farm was isolated from the rest of the village, and its water-supply for household purposes was got from a well with pump in the house. For some time in the earlier part of the year, this man was, in common with other members of his family, the subject of diarrhœa, general malaise, and exhaustion. On consulting a medical man in London he was advised to have the drinking water examined, which he accordingly did, with the result that it was found to be largely contaminated with organic matter. However, he set his own opinion against that of the chemist, for, "quem Deus vult perdere, prius dementat", and continued to drink the water. After several months of this sewage saturation of the system, he and his wife, on medical advice, went for a change to Weymouth, where they stayed for some days, suffering—at any rate, during a part of the time—from diarrhœa. On their return, they passed in the train through Southampton, where cholera was then prevailing. It is not supposed that they stayed there longer than the express train stops. The result was that shortly after their return they were attacked with cholera and died. There were also attacked six other members of the family, three of whom died. In addition, the medical attendant and a labourer employed about the house were attacked and died. Finally, a woman employed in laying out the corpse of the latter, and also her grandchild, fell victims and died. The well was contaminated with fæces from the cesspool which received the excreta of the patients first attacked. In all, twelve persons were attacked and nine died, whilst the neighbourhood remained quite free from cholera. This remarkable, and I might almost say classical, instance, which we owe to the researches of Mr. Netten Radcliffe, shows how that, by previous drinking of sewage, the bodies of the first two patients were predisposed to cholera, the poison of which they greedily imbibed during a short stay in an infected locality; and it also shows that, sewage drinking notwithstanding, the specific disease did not make its appearance in the household till the specific poison was imported by the first cases.

I will say but one or two words in reference to Dr. Snow's history of the epidemic in Golden Square. It is well known how that epidemic devastated a district within a radius of 250 yards from a certain public pump, sparing those communities within this radius who did not use the water of this

pump, and also, there is reason to believe, individuals who in like manner abstained. The purity of the water of this pump was highly thought of, and persons who had other pumps nearer to them were at the trouble to resort to it. Nor was this confidence altogether without reason, for even at the time of the epidemic its waters were shown to be much less contaminated than those of other pumps in the neighbourhood used by persons who escaped the cholera. Does not this point to a specific contamination of the water?

In the year 1865 the island of Malta was attacked with cholera, the first case among the population occurring on the 20th of June. On the 21st of July the disease appeared in the island of Gozo, three miles to the west of Malta, in the person of a seaman who had just returned from a nine days' stay in Malta. The next four cases were two sisters and two female neighbours of the same. Thereafter the disease spread, and there were 545 cases in all, 242 being fatal, amongst the population of this island, numbering something over 15,000. In like manner, there is the strongest evidence to show that the disease was imported into Gibraltar from Malta.

Lastly—and I must apologise for having wearied you with so much that is old, though none the less striking for that—I will merely allude to the remarkable history of the introduction of the disease into the New World by the steamships *Virginia* and *England* in 1866, with those most interesting and instructive detailed accounts of limited outbreaks amongst persons in Nova Scotia who had been in connection with these ships, and the history of how it was conveyed by them to their families. There are numerous facts of this nature to be found in the writings of Netten Radcliffe, Parkes, Seaton, Snow, and many others, and I will merely repeat that, to my mind, one positive fact is worth twenty negative.

We now come to consider the second proposition, which maintains that the disease is never communicable from man to man, but that the poison is of a nature partly atmospheric and, perhaps, partly telluric, which may remain stationary, or at times have a widespread and vast diffusion. In addition to this, there is assumed to be in certain years what is known as an "epidemic constitution", a combination of meteorological conditions producing altered conditions in the earth, and thus facilitating the spread of the disease. With regard to the poison itself, regarding it as not of human origin, it has by some been called a "miasm", as though they would claim for it some affinity with marsh miasm, producing those diseases called malarial. But, after a moment's reflection, we are forced to see that there is no true resemblance

between the two poisons. The poison of malaria is essentially one which is stationary and rooted to the spot where it has its origin, whilst the cholera poison is the very type of an epidemic poison. We may compare the one to an army acting strictly on the defensive in a fort, and the other to a vast invading host, spreading devastation far and wide. Hence, if we deny the human origin of the cholera poison, we are forced to conclude that it has a nature quite unique, differing entirely from the malarial poison, except in the fact that it is not transmissible from man to man.

With regard to those conditions which make up what is called the epidemic constitution, they are not in any way inconsistent with the disease being contagious. Thus, to quote an official report, "the epidemic of small-pox, which began in England towards the close of 1870, and terminated in the second quarter of 1873, was part of a general epidemic outbreak of that disease of world-wide diffusion, marked wherever it occurred by an intensity and malignity unequalled by any previous epidemic of the disease within living memory." There are many other circumstances connected with epidemic diseases which point to an epidemic constitution. To quote Mr. Simon again: "Why the plague of the Levant has for the last two centuries been so unfamiliar to us; or why the yellow fever of the Mississippi has in particular years raged furiously in parts of Europe; or why our Black Death of the fourteenth century, though apparently still surviving in India, has never but that once been in Europe; or whither has gone our sweating sickness of three centuries ago; or whence have come the modern epidemics of cerebro-spinal meningitis,—these, and many like questions, which cannot at present be answered, seem to be evidence enough that, in the making of epidemics, contagion and a personal susceptibility may be factors in a partly *conditional* sense." By conditional, we are to understand dependent upon the concurrence of certain external conditions favourable to the increase and spread of the poisons.

The contention of those who deny the contagiousness of cholera is that this view of the manner of its spread is inadequate to account for it. But it has just been shown that in the case of diseases, some of which are in the highest degree contagious, there are certain facts connected with epidemics which cannot be accounted for by contagium alone, unaided by concurrent conditions. We are not a more highly vaccinated nation now than we were in 1870-73; possibly, in the face of constant agitation, less so. Small-pox is endemic among us. Why does it not spread as it did

then? There is some factor wanting. For want of a better name, we call it an epidemic constitution. There are, however, certain facts and classes of facts which come before us in local outbreaks in which there is no need to invoke this epidemic constitution, important as its *rôle* may be in widespread epidemics. I quote the following facts from Dr. Parkes in illustration: "At Meerut, in 1867, the 19th Hussars were 430 strong, and lost 1 man from cholera; three batteries of artillery were 610 strong, and lost 5 men from cholera; the 3rd Buffs were 679 strong, and lost 105 men from cholera; the Sepoys lost none." After quoting similar facts, Dr. Parkes says: "These facts show that the hypothesis of an epidemic influence produced by something floating in the air is incredible, and for such a partial distribution as is shown above, would be impossible. If these figures prove anything, it is that the cause of the tremendous loss in these stations is not a generally diffused cause, but a well-marked local development, having narrow limits, and sometimes involving a single barrack." Indeed, it seems impossible to avoid coming to the conclusion that these facts are more easily explained on the supposition of some local condition aiding the spread of contagion, than on any other.

With all deference to, and with the greatest respect for, those whose Indian experience has led them to believe that the theory of contagiousness, supplemented in exceptional years by the admission of an epidemic constitution, is inadequate to explain the maintenance and spread of cholera in and from India, I would venture to submit the following. The conditions of life in India, and in Eastern countries generally, are much more simple and primitive than those which obtain in Europe. The extreme climatic changes which we endure are there unknown, and the importance of guarding against such influences as we class under the general heading of "a chill", is habitually disregarded by the natives and imprudent Europeans. The heat produces thirst, and the native drinks whatever water comes first. The climate facilitates social intercourse, and men and women wander day and night among the bazaars, eating and drinking, and mixing with their fellow-men as the spirit pleases them. The importance of the predisposing causes of cholera has been already insisted upon as without a parallel in the history of specific diseases. The native is ignorant of or apathetic to these, and the luckless European lately landed in Bengal is equally ignorant and apathetic; whence it arises that new comers into a cholera district are especially liable to be attacked by cholera. The old European resident in India displays—both passively in

avoiding all noxious influences, and actively in checking such exciting causes as diarrhœa—a cunning which he has learnt by sad lessons from the incautious native and new comer.

In proportion as the conditions of life in any country are simple, so do the difficulties of working out to a satisfactory solution any sanitary problem increase. To cite one instance out of many. Had Cambridge been an Oriental instead of an English town, that masterpiece of careful investigation of facts and logical deductions therefrom, embodied in the report of Dr. Buchanan on the outbreak of typhoid fever in Caius College, could never have seen the light. I will further venture to assert my belief that our knowledge of the etiology of typhoid fever generally, did it rest on Eastern experience alone, would still be absolutely vague and untrustworthy. In saying this, I am fully aware that the investigators of India are quite as competent as our own. Lastly, there are two other facts, one of which has already been dwelt upon, which render the investigation of the etiology of cholera peculiarly difficult. These are our ignorance of the anomalous and slighter cases of this disease, and the rapidly fatal course which the disease so often runs, and which precludes inquiries where it would be most important to make them.

It is not my intention to discuss here the theory of Petenkofer, which holds that the poison is contained in the evacuations of the sick, but that it is necessary that it should undergo changes in the soil before it can be reabsorbed. Many weighty facts might doubtless be adduced in support of it, but they do not seem to prove more than that the condition of the soil, in common with many other conditions, may be an important factor in the spread of the disease. There is one important point, our ignorance of which would render the discussion of these views premature and liable to confuse the issue now in question, and that is the absence of any exact knowledge of the time necessary for the supposed changes to take place. Besides, there are important facts, such as the occurrence of outbreaks on board ship, which would seem to weigh heavily against the theory.

Nor is it my intention to discuss the views of those who regard the manner of the spread of the disease in Europe as possibly differing from that which obtains in India; or who hold that the disease may at times be contagious in India, but that it is not usually so. Such opinions appear—to me, at any rate—to be a somewhat illogical attempt to reconcile facts apparently inconsistent with one another, except in so far as the views are strictly limited to an explanation of the

consistency of the theory of Petenkofer with that of more immediate contagion.

Lastly, has the recent epidemic in Egypt thrown any new light on the mode of propagation of this disease? The supporters of the view that the disease is propagated from man to man are not able to adduce positive instances of its having been so propagated; but the history of the epidemic supplies facts which are at any rate suggestive of its having been so. The country was in a condition eminently fitted for the spread of a disease already endemic there. Added to the usual filthy habits of the natives, there was, as in 1865, the misery induced by the murrain. The mist which hung over Cairo at or about the time of the appearance of the epidemic there spread itself over the Boulak quarter, that is, the poor native quarter on the banks of the river, and over the Mooskee, the native quarter away from the river, alike. Yet it devastated the Boulak, but spared the Mooskee quarter. Now, the sanitary condition of the Mooskee is not superb, and doubtless many of its inhabitants were just as much predisposed as those in Boulak. Cannot this devastation of the Boulak quarter be explained by the fact that its inhabitants had one common water-supply, in which they bathed, from which they drank, and into which they passed their evacuations? This they had done for nearly twenty years without the appearance of an epidemic among them. Just as with the people in the farmhouse in Essex, it needed the importation of the specific poison before the predisposing cause took effect.

THE BEHAVIOUR OF CERTAIN EPIDEMIC DISEASES IN NATIVES OF POLYNESIA, WITH ESPECIAL REFERENCE TO THE FIJI ISLANDS.

By BOLTON G. CORNEY,
Colonial Surgeon, Fiji.

(*Read: April 9th*, 1884.

Before proceeding to the subject we have in hand this evening, I must ask your indulgence for one moment, in order that I may explain to you that I have no newly discovered facts or difficult scientific theories to introduce to your notice; but that, owing to my records being at the present time about sixteen thousand miles from London, I have merely, in response to the invitation with which you have honoured me, been able to throw together from memory a few observations which may be of interest to a medical mind, and which can, perhaps, afford pabulum for a little thought and conversation.

The photographs which are lying on the table before you were taken, with the aid of dry plates carried with him from England, by my friend Mr. Gerrard Ansdell, F.C.S., during a short sojourn in Fiji, and may serve to convey to you a fair conception of the physical appearance of the Fijian mountaineer tribes, and of some of the natives of the New Hebrides and Solomon Islands; and the two Admiralty charts I have pinned up will lend accuracy to your geographical knowledge. There is also a Fijian dictionary and grammar, which those among you who take an interest in the study of language may like to look into.

The epidemic of measles which ravaged the islands of the Fiji group began in the early part of 1875, and was the first visitation of its kind to which the natives there had been exposed. It was not until after its termination that I arrived in the colony; so that, in relating the history of the 1875 epidemic, you will understand that I am not speaking from my own observation at the time; although, by the opportunities since afforded me of gaining reliable information about it, chiefly through conversation with natives who were actual sufferers, and also with trustworthy European eye-

witnesses, I have been able to collect the leading facts of the occurrence, certainly in an accurate, as far as they go, if not in a comprehensive, form.

The knowledge which I have since gained by practical experience of the habits and tendencies of the Fijian race when suffering from illness, tends strongly to confirm in my own mind the numerical truth of the mortality returns when considered in relation to the causes which combined to bring about their excessively high rate. And I shall endeavour to show that this high rate of mortality was not so much the consequence of any special virulence of the disease itself, but that it resulted largely from a chain of circumstances, which, however uncontrollable at the time of the epidemic in question, are, or ought to be, preventable in the future, should the Fijians ever have the misfortune to be exposed to another visitation of zymotic disease.

It may be worth while to observe that the group of islands called by their inhabitants Viti, and known to us as Fiji, consists of about 250 islands, islets, and rocks, eighty or so of which are inhabited. They extend over a portion of the South Pacific Ocean, about 300 miles from east to west, and 240 from north to south, and are 1,100 miles distant in a northerly direction from New Zealand, being a little further eastwards from Queensland. The exact position of Levuka, where measles was first introduced, is lat. 17 deg. 41 min. S., long. 178 deg. 51 min. E. The island of Ovalau, upon which Levuka is situated, is about eight miles in diameter, oval in shape, and mountainous.

The largest island in the group is Viti Levu (*Anglicè*, Great Fiji), and is also irregularly oval, being ninety miles in its long diameter and sixty in the short: its area about equal to Jamaica or Cyprus. The comparative sizes of the other large islands you may see by glancing at the chart before you. That of the whole archipelago, as well as its position with regard to neighbouring islands and groups, is well shown upon the smaller scale chart of the South-West Pacific.

The topographical features of Fiji thus offer the greatest facilities for holding in check the spreading tendency of any zymotic disease, if one could exercise a rigid system of isolation upon any island where it first manifested itself. Owing, however, to the frequent communication which is kept up at ordinary times between island and island for trading purposes, etc., especially by the Fijians themselves, who are a maritime people, and very venturesome at sea, such isolation would be difficult to enforce. And in the case of the great

measles epidemic of 1875, the disease was disseminated throughout almost the entire group by this very means. For, while Thakombau and his sons and retinue were at Levuka, still able to communicate the disease, a great meeting of the chiefs from nearly every district took place, such as had never before been summoned, to discuss the political questions consequent on the annexation of the islands to the British Crown, and to sign the deed of cession.

I shall have to refer to this meeting again presently, but must first of all narrate the circumstances under which the disease came to be introduced.

The late ex-king, Thakombau, was in 1874 the most powerful and the most respected of all the chiefs of Fiji. Certain political and commercial considerations, which I need not detail, gave rise to the negotiations which ended in the cession of Thakombau's government to Great Britain; and in connection with these events, Thakombau visited Sydney as the guest of Sir Hercules Robinson, who was then Governor of New South Wales. Unfortunately, measles was very prevalent in most of the Australian colonies at that period, and one of the old chief's sons, Ratu Timoci, and a native servant, fell ill of that disease during their return voyage to Fiji in H.M.S. *Dido*. According to the report of Dr. Goodman, surgeon of the *Dido*, this occurred on the 6th of January 1875. On the 12th the *Dido* arrived at Levuka; and I regret to have to record the fact that the sick people, with their relatives, friends, and belongings, were permitted to land at once, without any attempt at isolation or quarantine. The tenor of the official correspondence which has been published in respect of this bungle is mutual recrimination between the authorities on shore and those on board the *Dido* —a shifting of blame from one to the other, *viri beibei*, as a Fijian would express it, with excuses which merely resolve themselves into a knotted tangle of red tape.

There was no quarantine law, as the colony had only been chartered so short a time, and the medical officers appointed by the Home Government had not yet arrived from England. Anyone who wishes to know the details of this affair can obtain them by referring to the official correspondence published by the Colonial Office on the subject.

So Thakombau and his sons, with their retinue, landed at Levuka on the 12th of January, with two of their number suffering from measles—it being the sixth day since the disease was identified, and the rash on the wane. Two days later, the other son and another attendant were attacked; and we are told also that on the 26th of the same month the

steamer *Wentworth* arrived at Levuka from Sydney, and was boarded by an officer from the *Dido*, to whom it was reported that a child of one of the passengers, Mrs. Tarte by name, had died of measles during the voyage, as well as its native nurse. In this case, also, no isolation was practised; and Mrs. Tarte took her surviving child ashore, to the house of a Mr. Moore at Levuka, whose children were all subsequently attacked by the disease.

The brig *Western Star*, also from Sydney, arrived about the same period with measles on board, and is said to have communicated the disease, through a boy named Bucknell, to another child of Mr. Moore, while at Suva. So much for the source of infection.

When the *Dido* arrived, she was boarded, I should have said, by the Administrator of the Government, with a boat's crew of native constabulary; and it is amongst these men that we next hear of the disease showing itself. They lived in so-called barracks, close to the Government buildings at Nasova, a suburb of Levuka, and numbered in all a hundred and forty-seven men. Every one of them eventually took the disease; but the first to suffer were the boat's crew who had been off to the *Dido*, and there fraternised with the attendants of the chief and his sons. Up to this time "the probability of its spreading caused no great apprehension. It was understood that the persons affected were convalescent, and they were isolated so far as was practicable or seemed necessary"(!)—I am quoting from a memorandum by the Acting Colonial Secretary, written on the 26th of June of that year, at the request of Sir Arthur Gordon—"but two causes strongly operated to spread the disease.

"1. The great number of Fijians who, in the second or third week after Thakombau's arrival, visited the village in which the ex-king lay.

"2. The impossibility of impressing the natives with a sense of their danger."

The first-named of these causes refers to the meeting of chiefs which I mentioned just now. It had been arranged for before the introduction of the disease; and owing to the widespread position of the various districts, and the fact that it was just then the middle of the hurricane or rainy season, when the winds are uncertain, there was not time to give notice of postponement, even if such a step had been thought necessary. As a matter of fact it was not; and though the disease was already implanted of course at Levuka, and consequently in Ovalau, it had not, on the arrival of the chiefs and their followers from the several districts, begun to spread.

These chiefs were sixty-nine in number, and their followers amounted to nearly five hundred persons. They came from the north and from the south, from the east and from the west. There were some from Viti Levu, some from Vanua Levu: from Kadavu, from Tavinui, and from Lau. Need I say how sure a means this accidental circumstance became of propagating the disease to the uttermost parts of the group, when the gathering broke up and its members returned to their homes?

Having all arrived in Levuka, they first met together to settle their official business, and afterwards proceeded to enjoy themselves by feasting and sight-seeing. The meeting took place on the 22nd of January, and on the 25th—that is to say, nineteen days after the first outbreak of measles on board the *Dido*, and eleven only since Ratu Timoci and his servant fell ill of it—these sixty-nine chiefs paid an official or complimentary visit to Thakombau in his "measly" house near Levuka. Two days later they went over H.M.S. *Dido;* and on the 3rd of March, about five weeks later, Mr. Harding reports from the mountains of Viti Levu that "all the chiefs who came to Levuka have measles, and it is spreading rapidly. They attribute it to poison and treachery. The attacks are so sudden and complete, that every soul in a village will be down at once; and no one will be able to procure food, or if obtainable, to cook it for themselves or others. The people have died from exhaustion and starvation in the midst of plenty."

In the meantime the disease had spread rapidly in Ovalau, from the original centre of infection; and "about the middle of February reports arrived from various provinces that measles had made its appearance. The districts of Kadavu and Rewa were first attacked; but the disease was spreading with great rapidity, and by the early or middle part of March disastrous news came in from all quarters."

It reached its maximum in Ovalau and Bau and their neighbourhood towards the end of March, and in most other places shortly after the beginning of April. The eastern or windward portion, however, was the last affected: a fact which may be accounted for by the lesser facilities which exist there for communication between island and island, owing to the danger of the navigation and the absence of protecting reefs. It did, however, get as far as Ono, which is the most windward place in the group, and consists of a small cluster of islets 240 miles to the south-eastward of Levuka, and over 100 miles from any other civilised place. The infection was carried to it by a canoe sent by the cele-

brated chief Maafu with yams from Loma Loma to relieve the inhabitants, who were reported to be short of food.

About this time we have a record of letters coming in from all parts, describing the ravages of the disease among the natives, and their consequently forlorn state. On April 20th, for instance, Capt. Barrack, of Savu Savu, writes: "I am quite certain we shall lose twenty-five per cent. of the population: if this goes on much longer it will be nearer fifty." He complains that the healthy as well as the sick are panic-stricken, and get quite indifferent about one another; and says that "they sit and look on at their relations and friends dying for want of a drink or a bit of food." He adds that Mrs. Barrack made over five hundred dysentery pills (calomel, opium, and ipecac.) in one week, and was among the sick daily: and it is encouraging to learn that owing to the isolation which this lady enforced upon their own labourers, who, though of a different race from Fijians, were equally unfamiliar with measles, none of these were attacked.

A native teacher named Aiselea (Wesley) writes:—"The healthy congregate together; the sick are left to themselves for very fear." And the Rev. Mr. Webb, a Wesleyan missionary, relates that "that ere long the people lay down in masses . . . . . old men and infants, young men and mothers of families, one heap of illness." Strong winds and rains added to the horrors of the situation; and starvation was imminent as a consequence of all hands being simultaneously laid up. This, indeed, was one of the main causes of the mortality: and a great want of food occurred, or rather, of physical strength necessary to dig and carry in the yams and "dalo". For the same reason the Government could purchase no supplies for distribution.

In Ovalau, mortality was very great; and many small craft lay in harbour without crews to man them. Sick and dying were attended to only by Europeans, many of whom also contracted the disease; and burials became almost an impossibility. Medicines and other necessaries were freely given by the magistrates and many of the settlers, and much good was doubtless effected. The observations and experience, however, of persons so engaged lead to the conclusion that practically medicine and food were of less importance or value than advice and encouragement: it was possible in some degree to persuade a patient from exposing himself to wet and cold; but owing to the unfortunate belief which possessed the natives, that they were being bewitched, and that the plague was the consequence of annexation to

the white man's empire, it was seldom they would swallow our medicine or partake of our food.

It is recorded that "as the native population has conceived an idea that the sickness was introduced for the special purpose of carrying them off, very few have availed themselves of the offer of hospital accommodation; and many of the sick appear to consider that their only chance of recovery depends upon their not being forced to take European food and medicine." They preferred rather, when overtaken by the fever, and blurred by the rash, to crawl out of their houses and cool their bodies by lying on the damp ground, or in the bed of the nearest creek. Guards were placed over them wherever and whenever possible; but many confessed to escaping at night into friends' houses, and to lying down in waterholes and creeks, or the sea. All these speedily developed dysentery or pneumonia, and died miserably.

As a set-off to this state of affairs, we are reassured by learning, as an evidence of the good results where medical treatment and discipline could be *enforced*, that there was only a slight mortality amongst the members of the Armed Native Constabulary at Nasova. These men lived in so-called barracks, and were under English military discipline. Every one of them, a hundred and forty-seven strong, as I have already mentioned, took the disease; but only nine died. Of course they were all male adults in the prime of life; but six per cent. was their death-rate, as against 26 per cent. of the entire native population. And it happened that amongst the labourers indentured to planters and merchants, the mortality was comparatively small, and that in a few instances, even, the disease never reached them. This was owing to the isolation and discipline which their employers were able to insist upon, among the indentured working population on the various estates. These people were mostly natives of the Solomon Islands, New Hebrides, and Line Islands, who had emigrated to Fiji for a three years' term of indenture; and who were dependent upon their employers, not only for medicine and sanitary care, but for food and housing.

Further, in a letter written by Mr. Emberson, one of the magistrates, whose station was Lau, but *who was absent from home* at the time of the outbreak, he says:—"On my return here, I found death, desolation, and starvation staring the people in the face, and their stern sway is as yet unbroken. Whole families have been carried off, and, but for the incessant beat of the death-drum, one might fancy the place deserted. All my constables are ill, and the people have no one left to bring them food, firewood, medicine, or water, or

to perform the necessary duties of cleansing the houses. They lose courage, cower down to die; and die they do, in dozens and in hundreds. I attended first to the most sensible and influential people, hoping, if they recovered, that heart would be inspired into the others; but the proverb, 'God helpeth those who help themselves', is being fearfully verified."

I might quote numerous other instances from both official and private records of the epidemic, all of which go to show that the high rate of mortality, which, as I have already stated, amounted to no less than 26 per cent., was brought about mainly in consequence of all the people being infected at or about the same time, because none of them were protected by a previous attack of measles. The nation presented a virgin field for its insemination and development. Also, by the untutored and uncontrollable habits of the natives in giving up hope and reason, or acting purely in ignorance, as manifested by their proneness to bathe in cold water, or expose their bodies to cooling influences, such as night air, draughts, or damp earth, when in a state of high fever; these inconsistencies resulting very naturally in dysentery and pneumonia and death. Starvation was a secondary cause, brought about by the first I mentioned, there being no healthy people available to provide food and look after those that were sick. Want of cleanliness, speedy and efficient disposal of the dead, and other sanitary precautions, may be classed under the same category; and superstition and despair contributed also to the fatal results.*

The point which I wish to establish, therefore, is that whatever virulence there may have been in this particular epidemic—and we know that epidemics of measles vary very much in this respect—the excessively high rate of mortality which resulted was not only a direct consequence of the disease being implanted in a nation to whose ancestors, history, and traditions it had hitherto been a stranger, but that it occurred in great measure in a secondary manner, and was brought about in the ways which I just now indicated. In by far the greater number of fatal cases, the cause of death

* It is an indisputable fact that some Polynesians will express their intention of dying, coil themselves away in a corner, and actually die within twenty-four hours, without any sufficient symptoms being discernible to a medical man during life or detectable by *post mortem* examination. It *may* be poison; but the natives attribute it to bewitchment by means of some *other* person eating the poison; so that mental emotion is probably the cause. I have known this happen to a Solomon Islander on the arrival of a ship from his home, bringing a yarn that his cousin had eaten certain leaves and clay, with a view to spite him for some old cause of feud—the bewitcher being 1,350 miles away from the bewitched. Numerous similar instances are spoken of by settlers.

was dysentery or pneumonia, or both together; and these diseases were mainly produced by causes which in a civilised community, even if all new to measles, would not have operated. I know that it is usual to believe that a virgin community will suffer more, other things being equal, on a disease being introduced among them, than will one whose ancestors have been exposed to its influence during successive generations. It may be so, and probably is; but I am confident that, in the case of this epidemic of measles in Fiji, more stress has been generally laid upon this hypothesis than the facts warrant us in believing to have been the fulfilment of it.

I regret that I am not able to lay before you the complete statistics of the mortality. I believe they have not been published *in extenso*. But "not less than 40,000" are the words given by Sir Arthur Gordon in an official despatch* to the Secretary of State as the total number of deaths resulting from the epidemic. The total population soon after its termination was 110,000 Fijians, about 4,000 Polynesians from other islands, 300 half-castes, and 2,000 Europeans, Americans, and Australians. In the two islands of Ovalau and Koro, with a population before the epidemic of 1,546 and 2,543 respectively, 447 and 688 died from it:—equal to 28 and 27 per cent. And in the larger district of the Ba river, with a population of 7,925, the same proportion died, viz., 2,214. Among Polynesians belonging to other groups of islands, but temporarily resident in Fiji, and previously unacquainted with measles, the mortality was considerably less, owing, as I have explained, to the care and influence which could be not only proffered, but enforced by their white employers.

From the middle to the end of March, the disease reached its maximum in Ovalau and the islands to the westward; elsewhere, except Lau (lying furthest to windward), in the beginning of April. By the first of May it had almost died out in Ovalau, and was rapidly declining in the more accessible parts of Viti Levu. Plain directions for nursing and the maintenance of cleanliness had been printed in the Fijian language, and were distributed among the natives; and hygienic measures were now taken—as soon as enough people recovered strength to do the work—to cleanse the villages and raise mounds of earth over the bodies of the half-buried dead. But the sites of the natives' villages were at that time always bad, being chosen with a view to security against an enemy in human form only. Morasses and low-lying places, with dense and often impenetrable vegetation all round them, were the

* C, 1624, No. 23, anno 1875.

positions generally selected. These were fortified by double or treble trenches and dykes, closely planted with arums and lemon bushes respectively, the trenches often becoming a receptacle for the rotting fruit and the yam peelings, offal, and other refuse of the town. To make matters worse, the inevitable pig would frequently find out the shallow graves, and unearth the bodies of those most recently buried.

By the 30th of May, the epidemic was practically at an end; and as this was only four months from the date of its commencement, the death-rate, *while it lasted*, must have been in the proportion of no less than 78 per cent. per annum.

Since 1875, measles has again occasionally made its appearance in Fiji, and may now be regarded as endemic there. Once it was reintroduced from Sydney, once from Auckland, and once from Melbourne. It occurs from time to time in the Lau and Taviuni districts and in Levuka—handed down, it would seem, from the 1875 infection by means of clothing, new babies, and labourers introduced from other groups. The Sydney case (in 1880) extended to seventeen new ones along the estates on the Waimanu; but the cases always come to the knowledge of a District Medical Officer, are well looked after, and nourished by suitable food and drink administered by a European; and out of all those which have occurred in Fiji since the close of the 1875 epidemic, there has been only a single death, and that an infant.*

I have not met with any case of measles occurring for the second time in a Polynesian native, including Fijians, though I am not in a position to affirm that such has never been the case.

There is no doubt that this disease has run through the islands of the New Hebrides and most of the Solomon group, perhaps also the Santa Cruz and Torres islands, for the natives of those islands who come to Fiji relate stories about a "big sickness" which visited their families some few years ago, and was brought by trading vessels from Sydney. I have myself had natives of Santa attending upon measles cases in white children without taking the disease themselves.

The unfortunate *Dido* is pointed at by the natives of Malakula as the vessel which carried infection to their shores. It is known that she returned a hundred or so Polynesians to their homes (from Fiji) about a month after Thakombau and his suite had brought measles to Fiji in the ship; and the Malakula natives informed the master of the schooner *Daphne*, in 1875, of certain labourers who had been returned from Fiji, saying that they had had a visit from a "big fellah ship

* A Gilbert Islander.

—a steamer with three fellah mast", which landed "plenty men. These fellah get plenty sick; by-and-bye plenty fellah die." And the people who reported this conversation saw none but a few women about, and could not obtain yams or bread-fruit.

The evidence of measles having been in these islands is corroborated by European missionaries, who have seen much of the natives of them, and are able to understand and speak some of their languages. I was there myself in 1876.

So far as I can ascertain, or remember without reference to my notes, I believe measles has not yet visited the islands of Tonga and Samoa, nor the Fijian dependency of Rotuma; and no vessels are allowed to communicate with the latter, upon which an English Commissioner resides, without producing a clean bill of health, signed by the port medical officer at Suva or Levuka.

This brings to a conclusion what I have to tell you about measles, and I may pass on to the consideration of the next epidemic disease to which I propose to refer, and that is influenza.

I have noticed on several occasions during my eight years' stay in Fiji the occurrence of a distinctly epidemic outbreak of influenza. In that part of the group over which my information has been chiefly gleaned, the news of its prevalence has always first reached me from Levuka. This is, of course, partly owing to the fact that that town was the settlement with which I had the most frequent and regular mail communication; but I want you to bear in mind its position—to windward of Suva, where I lived. It follows in Suva about a fortnight later, and in the interval declares itself in Bau, Tai Levu, and along the native villages and labouring population situated on the banks of the Rewa river, whose course lies intermediate between the two towns above mentioned. Later on, we hear in Suva of its having been prevalent in Lau, but at an earlier date than at Levuka, and the news reaches us last because of the long distance that district is from Suva, and the irregularity of the mails from it. Batiki and Nairai get it about a week earlier than Bau and Levuka, as their position would lead one to expect.

The disease appears to me to be spread chiefly through the agency of the trade-wind, which blows generally from east-south-east: a process which I have reason to believe is also partly the case with a form of conjunctivitis which is annually epidemic in most parts of Western Polynesia. With the former disease, however, season does not seem to have anything to do; with the latter, on the contrary, almost everything.

Unfortunately, I have only brought notes home with me of one of these outbreaks of influenza; but it was a typical one, and the most severe that I remember. It occurred last year, in January and February—the two hottest months of any. I remember hearing, about the latter part of January, that the Levuka people were "down with colds", as they describe it. On the 27th, an urgent message arrived from Bau, to say that the Vunivalu* was going to die; and upon receiving this news the Governor at once instructed me, with the Colonial Secretary, to proceed to Bau, and do what we could for the old chief. I remember saying to my companion, "They've been reached by the influenza wave at Bau by this time, and I expect the chief is getting bronchitis as a sequel to it." My surmise was wrong, however, as he died from natural decay, culminating in a carbuncle in the loin; which, having been neglected, was the immediate cause of his end. But I had an excellent opportunity of watching the course of influenza in his Fijian subjects, as I found nearly half the adult population of the town, which contains four hundred, then ill with it. The disease had attacked all the Fijians in Suva, within a fortnight of its climax at Bau; and my official returns show that on one day in February every man in the Armed Native Constabulary (then seventy-three strong) was on the sick-list. In the same week, out of 130 and odd prisoners in the gaol, mostly Fijians, the average daily sick amounted to nearly seventy, of whom sixty-four were cases of influenza and its sequelæ. Two were fatal; and another narrowly escaped, being three months laid up and convalescent from double pneumonia, before he could return to prison labour.

In the generality of cases of this affection which I have met with in Fijians, other Polynesians, and white men, the first symptom is a feeling of chilliness, usually at night, with perhaps a rigor: several natives told me of a feeling which they likened to that of ants creeping over their skin —formication. Others described this sensation by comparing it to a "cat's-paw" on the water. This is followed on the succeeding day by immoderate sneezing, aches and pains in the body and limbs, particularly the lumbar region, and severe headache. The temperature now rises; and on the evening after the first day may attain 101 deg.; and the patient has a dry, burning skin. Next morning he is somewhat freer from pain, but has coryza, with pharyngeal dryness and itching; and complains of having passed a sleepless night. Towards evening the temperature again

* Thakombau's native title.

measles epidemic of 1875, the disease was disseminated throughout almost the entire group by this very means. For, while Thakombau and his sons and retinue were at Levuka, still able to communicate the disease, a great meeting of the chiefs from nearly every district took place, such as had never before been summoned, to discuss the political questions consequent on the annexation of the islands to the British Crown, and to sign the deed of cession.

I shall have to refer to this meeting again presently, but must first of all narrate the circumstances under which the disease came to be introduced.

The late ex-king, Thakombau, was in 1874 the most powerful and the most respected of all the chiefs of Fiji. Certain political and commercial considerations, which I need not detail, gave rise to the negotiations which ended in the cession of Thakombau's government to Great Britain; and in connection with these events, Thakombau visited Sydney as the guest of Sir Hercules Robinson, who was then Governor of New South Wales. Unfortunately, measles was very prevalent in most of the Australian colonies at that period, and one of the old chief's sons, Ratu Timoci, and a native servant, fell ill of that disease during their return voyage to Fiji in H.M.S. *Dido*. According to the report of Dr. Goodman, surgeon of the *Dido*, this occurred on the 6th of January 1875. On the 12th the *Dido* arrived at Levuka; and I regret to have to record the fact that the sick people, with their relatives, friends, and belongings, were permitted to land at once, without any attempt at isolation or quarantine. The tenor of the official correspondence which has been published in respect of this bungle is mutual recrimination between the authorities on shore and those on board the *Dido* —a shifting of blame from one to the other, *viri beibei*, as a Fijian would express it, with excuses which merely resolve themselves into a knotted tangle of red tape.

There was no quarantine law, as the colony had only been chartered so short a time, and the medical officers appointed by the Home Government had not yet arrived from England. Anyone who wishes to know the details of this affair can obtain them by referring to the official correspondence published by the Colonial Office on the subject.

So Thakombau and his sons, with their retinue, landed at Levuka on the 12th of January, with two of their number suffering from measles—it being the sixth day since the disease was identified, and the rash on the wane. Two days later, the other son and another attendant were attacked; and we are told also that on the 26th of the same month the

steamer *Wentworth* arrived at Levuka from Sydney, and was boarded by an officer from the *Dido*, to whom it was reported that a child of one of the passengers, Mrs. Tarte by name, had died of measles during the voyage, as well as its native nurse. In this case, also, no isolation was practised; and Mrs. Tarte took her surviving child ashore, to the house of a Mr. Moore at Levuka, whose children were all subsequently attacked by the disease.

The brig *Western Star*, also from Sydney, arrived about the same period with measles on board, and is said to have communicated the disease, through a boy named Bucknell, to another child of Mr. Moore, while at Suva. So much for the source of infection.

When the *Dido* arrived, she was boarded, I should have said, by the Administrator of the Government, with a boat's crew of native constabulary; and it is amongst these men that we next hear of the disease showing itself. They lived in so-called barracks, close to the Government buildings at Nasova, a suburb of Levuka, and numbered in all a hundred and forty-seven men. Every one of them eventually took the disease; but the first to suffer were the boat's crew who had been off to the *Dido*, and there fraternised with the attendants of the chief and his sons. Up to this time "the probability of its spreading caused no great apprehension. It was understood that the persons affected were convalescent, and they were isolated so far as was practicable or seemed necessary"(!)—I am quoting from a memorandum by the Acting Colonial Secretary, written on the 26th of June of that year, at the request of Sir Arthur Gordon—"but two causes strongly operated to spread the disease.

"1. The great number of Fijians who, in the second or third week after Thakombau's arrival, visited the village in which the ex-king lay.

"2. The impossibility of impressing the natives with a sense of their danger."

The first-named of these causes refers to the meeting of chiefs which I mentioned just now. It had been arranged for before the introduction of the disease; and owing to the widespread position of the various districts, and the fact that it was just then the middle of the hurricane or rainy season, when the winds are uncertain, there was not time to give notice of postponement, even if such a step had been thought necessary. As a matter of fact it was not; and though the disease was already implanted of course at Levuka, and consequently in Ovalau, it had not, on the arrival of the chiefs and their followers from the several districts, begun to spread.

measles epidemic of 1875, the disease was disseminated throughout almost the entire group by this very means. For, while Thakombau and his sons and retinue were at Levuka, still able to communicate the disease, a great meeting of the chiefs from nearly every district took place, such as had never before been summoned, to discuss the political questions consequent on the annexation of the islands to the British Crown, and to sign the deed of cession.

I shall have to refer to this meeting again presently, but must first of all narrate the circumstances under which the disease came to be introduced.

The late ex-king, Thakombau, was in 1874 the most powerful and the most respected of all the chiefs of Fiji. Certain political and commercial considerations, which I need not detail, gave rise to the negotiations which ended in the cession of Thakombau's government to Great Britain; and in connection with these events, Thakombau visited Sydney as the guest of Sir Hercules Robinson, who was then Governor of New South Wales. Unfortunately, measles was very prevalent in most of the Australian colonies at that period, and one of the old chief's sons, Ratu Timoci, and a native servant, fell ill of that disease during their return voyage to Fiji in H.M.S. *Dido*. According to the report of Dr. Goodman, surgeon of the *Dido*, this occurred on the 6th of January 1875. On the 12th the *Dido* arrived at Levuka; and I regret to have to record the fact that the sick people, with their relatives, friends, and belongings, were permitted to land at once, without any attempt at isolation or quarantine. The tenor of the official correspondence which has been published in respect of this bungle is mutual recrimination between the authorities on shore and those on board the *Dido* —a shifting of blame from one to the other, *viri beibei*, as a Fijian would express it, with excuses which merely resolve themselves into a knotted tangle of red tape.

There was no quarantine law, as the colony had only been chartered so short a time, and the medical officers appointed by the Home Government had not yet arrived from England. Anyone who wishes to know the details of this affair can obtain them by referring to the official correspondence published by the Colonial Office on the subject.

So Thakombau and his sons, with their retinue, landed at Levuka on the 12th of January, with two of their number suffering from measles—it being the sixth day since the disease was identified, and the rash on the wane. Two days later, the other son and another attendant were attacked; and we are told also that on the 26th of the same month the

steamer *Wentworth* arrived at Levuka from Sydney, and was boarded by an officer from the *Dido*, to whom it was reported that a child of one of the passengers, Mrs. Tarte by name, had died of measles during the voyage, as well as its native nurse. In this case, also, no isolation was practised; and Mrs. Tarte took her surviving child ashore, to the house of a Mr. Moore at Levuka, whose children were all subsequently attacked by the disease.

The brig *Western Star*, also from Sydney, arrived about the same period with measles on board, and is said to have communicated the disease, through a boy named Bucknell, to another child of Mr. Moore, while at Suva. So much for the source of infection.

When the *Dido* arrived, she was boarded, I should have said, by the Administrator of the Government, with a boat's crew of native constabulary; and it is amongst these men that we next hear of the disease showing itself. They lived in so-called barracks, close to the Government buildings at Nasova, a suburb of Levuka, and numbered in all a hundred and forty-seven men. Every one of them eventually took the disease; but the first to suffer were the boat's crew who had been off to the *Dido*, and there fraternised with the attendants of the chief and his sons. Up to this time "the probability of its spreading caused no great apprehension. It was understood that the persons affected were convalescent, and they were isolated so far as was practicable or seemed necessary"(!)—I am quoting from a memorandum by the Acting Colonial Secretary, written on the 26th of June of that year, at the request of Sir Arthur Gordon—"but two causes strongly operated to spread the disease.

"1. The great number of Fijians who, in the second or third week after Thakombau's arrival, visited the village in which the ex-king lay.

"2. The impossibility of impressing the natives with a sense of their danger."

The first-named of these causes refers to the meeting of chiefs which I mentioned just now. It had been arranged for before the introduction of the disease; and owing to the widespread position of the various districts, and the fact that it was just then the middle of the hurricane or rainy season, when the winds are uncertain, there was not time to give notice of postponement, even if such a step had been thought necessary. As a matter of fact it was not; and though the disease was already implanted of course at Levuka, and consequently in Ovalau, it had not, on the arrival of the chiefs and their followers from the several districts, begun to spread.

measles epidemic of 1875, the disease was disseminated throughout almost the entire group by this very means. For, while Thakombau and his sons and retinue were at Levuka, still able to communicate the disease, a great meeting of the chiefs from nearly every district took place, such as had never before been summoned, to discuss the political questions consequent on the annexation of the islands to the British Crown, and to sign the deed of cession.

I shall have to refer to this meeting again presently, but must first of all narrate the circumstances under which the disease came to be introduced.

The late ex-king, Thakombau, was in 1874 the most powerful and the most respected of all the chiefs of Fiji. Certain political and commercial considerations, which I need not detail, gave rise to the negotiations which ended in the cession of Thakombau's government to Great Britain; and in connection with these events, Thakombau visited Sydney as the guest of Sir Hercules Robinson, who was then Governor of New South Wales. Unfortunately, measles was very prevalent in most of the Australian colonies at that period, and one of the old chief's sons, Ratu Timoci, and a native servant, fell ill of that disease during their return voyage to Fiji in H.M.S. *Dido*. According to the report of Dr. Goodman, surgeon of the *Dido*, this occurred on the 6th of January 1875. On the 12th the *Dido* arrived at Levuka; and I regret to have to record the fact that the sick people, with their relatives, friends, and belongings, were permitted to land at once, without any attempt at isolation or quarantine. The tenor of the official correspondence which has been published in respect of this bungle is mutual recrimination between the authorities on shore and those on board the *Dido* —a shifting of blame from one to the other, *viri beibei*, as a Fijian would express it, with excuses which merely resolve themselves into a knotted tangle of red tape.

There was no quarantine law, as the colony had only been chartered so short a time, and the medical officers appointed by the Home Government had not yet arrived from England. Anyone who wishes to know the details of this affair can obtain them by referring to the official correspondence published by the Colonial Office on the subject.

So Thakombau and his sons, with their retinue, landed at Levuka on the 12th of January, with two of their number suffering from measles—it being the sixth day since the disease was identified, and the rash on the wane. Two days later, the other son and another attendant were attacked; and we are told also that on the 26th of the same month the

steamer *Wentworth* arrived at Levuka from Sydney, and was boarded by an officer from the *Dido*, to whom it was reported that a child of one of the passengers, Mrs. Tarte by name, had died of measles during the voyage, as well as its native nurse. In this case, also, no isolation was practised; and Mrs. Tarte took her surviving child ashore, to the house of a Mr. Moore at Levuka, whose children were all subsequently attacked by the disease.

The brig *Western Star*, also from Sydney, arrived about the same period with measles on board, and is said to have communicated the disease, through a boy named Bucknell, to another child of Mr. Moore, while at Suva. So much for the source of infection.

When the *Dido* arrived, she was boarded, I should have said, by the Administrator of the Government, with a boat's crew of native constabulary; and it is amongst these men that we next hear of the disease showing itself. They lived in so-called barracks, close to the Government buildings at Nasova, a suburb of Levuka, and numbered in all a hundred and forty-seven men. Every one of them eventually took the disease; but the first to suffer were the boat's crew who had been off to the *Dido*, and there fraternised with the attendants of the chief and his sons. Up to this time "the probability of its spreading caused no great apprehension. It was understood that the persons affected were convalescent, and they were isolated so far as was practicable or seemed necessary"(!)—I am quoting from a memorandum by the Acting Colonial Secretary, written on the 26th of June of that year, at the request of Sir Arthur Gordon—"but two causes strongly operated to spread the disease.

"1. The great number of Fijians who, in the second or third week after Thakombau's arrival, visited the village in which the ex-king lay.

"2. The impossibility of impressing the natives with a sense of their danger."

The first-named of these causes refers to the meeting of chiefs which I mentioned just now. It had been arranged for before the introduction of the disease; and owing to the widespread position of the various districts, and the fact that it was just then the middle of the hurricane or rainy season, when the winds are uncertain, there was not time to give notice of postponement, even if such a step had been thought necessary. As a matter of fact it was not; and though the disease was already implanted of course at Levuka, and consequently in Ovalau, it had not, on the arrival of the chiefs and their followers from the several districts, begun to spread.

analogy to syphilis. It is rarely fatal: in Fijians I have never seen it so; and in the few instances which have come before me in other Polynesians, the cause of death has usually been diarrhœa. It is generally communicated by house flies, when they pass from a yaw to a sore, or a scatch on a healthy person. It does not appear to be infectious, but its power of contagion by means of virus from the sore is certain, and I have no doubt that it is also inoculable by blood. When white men get it they suffer very severely; sometimes for years. Venereal diseases are very rare in Fijians, owing to their virtuous habits and circumcision; but in many of the Solomon Islands and New Hebrides they have now gained a footing, having been introduced, it is currently believed, by whaling crews as much as a hundred years ago. They often produce in men the most horrid local effects, owing to the exceedingly long prepuce with which the Papuan races are endowed; but I cannot recollect any case of severe secondary or tertiary syphilis. One feels inclined to connect this immunity with the yaws question; but definite and systematic researches are as yet incomplete.

At Malakula, where they circumcise, I have never seen a case of venereal affection: and every man's genital organs are open to view, owing to the paucity of their dress. In the course of my duties as Medical Officer to the Immigration Department in Fiji, I have, however, carefully examined over seven thousand natives of other groups who have come to Fiji as labourers; and until the most recent years the proportion of venereal cases was decidedly small. The "Polynesian labour traffic" to Fiji, Queensland, and New Caledonia, has been over and over again—to a great extent unfairly—decried; but I am afraid that the spread of syphilis, chancroid, and gonorrhœa, may be in some measure truthfully ascribed to its operation, notwithstanding medical supervision and care. Hundreds of cases of warts and balanitis, however, which occur in these (Papuan) races, are merely the result of long prepuce with narrow orifice, without any sexual origin whatever; and might be easily avoided by circumcision, or by employing a more careful and less hasty toilet than is usual with these singular people.

Certain parasitic skin diseases are very common in Western Polynesia, notably chloasma, and a form of ring-worm which we call *Tinea desquamans*. The latter often covers the entire surface of a native except the scalp, and is a great disfigurement. When of moderately recent origin, fumigation by sulphurous acid, aided by scrubbing and soft soap, will effect a cure; but mercurial applications mostly fail, and so

does sometimes even chrysophanic acid. This disease was unknown in Fiji prior to the introduction of Polynesian labourers from the Line Islands and Solomons about 1870. I believe it extends to New Guinea; and I know it is exceedingly common in New Britain, New Ireland, and as far west as the Admiralty group. There it is not of recent origin, one at least of the early Spanish navigators, and I believe old Dampier also, having mentioned it by describing the natives as being "covered with scales like unto a fish".

Scabies, and various queer-looking eruptions due to the several forms of pediculi and their scratching, are common in places where the natives do not frequently bathe.

Epidemic gangrenous stomatitis, with an analogous condition of rectum, forms the most fatal of all the diseases which I have met with in the South Seas: and its distribution seems almost entirely regulated by idiosyncrasy of race.

ON THE COLONISATION OF THE SUB-HIMALAYAHS AND NEILGHERRIES, WITH REMARKS ON THE MANAGEMENT OF EUROPEAN CHILDREN IN INDIA.

By JOSEPH EWART, M.D., F.R.C.P.,
Physician to the Royal Alexandra Hospital for Sick Children, Brighton.

(*Read*: *May 14th*, 1884.)

1. *Colonisation.*—In the sanitary and ethnological history of the low-lying lands or plains of British India there is one fact which stands forth with conspicuous prominence, viz., the absolute powerlessness of Europeans to thrive and continue their race through many successive generations. Twining declared that there was no known instance in his time of a pure European descent in the country extending beyond the third remove; and Sir Joseph Fayrer's observation prolongs it to the fourth generation only, and no further. The Portuguese in Ceylon and India have, perhaps, been more fortunate. To what extent, I do not know; for their descendants now met with are much mixed, and decidedly not prolific, any more than is the Anglo-native amalgam. Barrenness among the women of this mixture is common to a considerable extent. Physical, intellectual, and procreative degeneration, doubtless tending in the long run to ultimate extinction, is probably the master characteristic of all.

Yet the country is one in which the natives live, thrive, and breed with amazing success. Even in Bengal, the race, though subsisting mainly on vegetable food, is tolerably robust, intellectually capable of much development and cultivation, and ethnologically the same or more advanced than it was four thousand years ago. In the upland plains of Behar, Oude, the North-West Provinces, and the Punjaub, no finer muscular specimens of mankind can be found in any part of the world. The same observation, in great part, may be applied to the Rajputs of Rajpootana, to the Mahrattas of the Bombay Presidency and the Deccan, and, in a measure, to the Dravidians of the Madras Presidency. The aborigines

of the hills of Orissa, the Southals of Bengal, the Bheels and Gonds of the mountainous tracts of Rajpootana, Central India, Vyndhyas, and other hilly regions, and the other aborigines driven to such localities by their Aryan conquerors, are the unmixed descendants of ancestors leading us back to, or it may be even beyond, the stone age of the world's history. All these races—dark skinned, black eyed, jet-black haired—have sustained themselves not only with impunity, but with apparent improvement, and capacity for still greater advancement. Among the Aryan portion of them are to be found the somewhat cocoa-nut headed, clear, quick-eyed, lithe and supple-limbed, teetotal, priestly Brahmins, who, by means of their intellectual superiority, learning, and moral force, exercise despotic supremacy over vast masses of the people in all matters connected with religious faith. The heat and malaria and other adverse influences of the climate affect them much, but not so as to interfere with, or to place a ban upon, the maintenance of the race. The population has been repeatedly decimated by war, pestilence, and famine, both before and during our supremacy, carrying off many millions of the people at different times; but the tenacity of the Hindus, Mohammedans, and aborigines to the soil to which they have become naturalised is such that, as has been proved by recent census returns and reports, only a few short years are required to enable them to retrieve or exceed in numbers the loss so occasioned.

Not so with alien races, and especially with that to which we belong. I used to think, in my earlier service, that the reason of this was the heat, malaria, and other tropical causes of ill-health, superadded to mode of living, too much animal food, constitutional habit, and so forth. But, on reflection, it is plain that this will not suffice. It is manifest that, as regards climatic agencies, the two races are equally exposed. If there be any inequality, it would probably be in favour of the well-cared-for, well-fed, and well-housed European. In what, then, does this difference consist? I confess I do not know. I have seen it stated somewhere that the dark skin has the power of intercepting or neutralising the calorific rays of the sun or heat, and that the excess of dark pigment in the interior of the eye performs a similar service in protecting the retinæ and the nerve-centres with which they are connected from the immense glare of a tropical sun. Certain it is that the native, with head and spine bare and unprotected, will work in the open day under a blazing sun that would prostrate a European Aryan with heat exhaustion, heat apoplexy, or thermic fever.

Another marked difference is that the natives live mainly upon vegetable and unstimulating vegetable food. But this cannot be the reason, inasmuch as the rice, wheaten flour, lentils, etc., consumed contain a good deal of heat-producing material. Whatever the reasons may be, one thing is proved by our occupation of India, that, whilst the indigenous descendants of the Aryan conquerors of Hindostan can successfully maintain themselves, and evince great capacity for intellectual advancement and improved civilisation, equally with, or more so than, the aborigines, the very much mixed Aryan Anglo-Saxon struggles during the first, dwindles and degenerates during the second, and becomes extinct during the third (Twining) or the fourth generation (Fayrer).

Thus, although the effects of climate can be much mitigated both in adults and children, anything like colonisation such as we have seen and now see going on in Canada, the United States, the Cape of Good Hope, Australia, New Zealand, and Tasmania, is totally impracticable. This truth is noted in the degeneracy of our race wherever it has been attempted in the plains of India, and in none does it become so palpably demonstrated as in our children. Hence the wisdom of frequent change to the hills, or Europe, or both, for adults, and early transfer of children to Europe for physical training and intellectual education. Hence the necessity for frequent change of the European troops to this country; for, although the effects of prolonged residence may be alleviated by increasing knowledge of the means to be used to withstand the climate and its ailments, there is no such thing as real or substantial acclimatisation for the European.

But is it so in those hill climates sufficiently elevated to be free from the generation of malaria, and temperate enough to render outdoor labour on the part of the European tolerable, healthy, and pleasant? I am not certain whether data at present exist to warrant a positive answer to this interrogatory. Perhaps not. But the information available will well repay careful and critical examination. This consists in the advantages which are derived by adults who periodically visit the hills—and in most who are not the subjects of visceral disease these are signal and decisive; and by children, who, if kept long enough there, are immensely benefited.

Here we are confronted with some rather unfavourable statistical revelations regarding the children of the Lawrence Asylums at Ootacamund, Abu, Sunawur, and Murree, in which it is shown that, whereas the death-rate per thousand in the period 1860-82 was 12.5 between the ages of five to ten, and 4.5 between those of ten to fifteen, from 1875 to

1879 it amounted to only 6.3 and 3.7 respectively in England. Thus, in the first quinquennial period, the mortality was almost twice as high in the hill stations named as in England, and in the second, the excess against the Asylums was 1.2. (*Report of Sanitary Commissioner with the Government of India for* 1881.)

At first sight, these figures might seem conclusive, for there can be no doubt that as regards food, accommodation, sanitation, and medical care, the Lawrence Asylums have been and are administered with special reference to the physical and mental training of their inmates. Nor is there any reason to suppose that the causes of over-mental pressure believed to exist in this country have any force in India.

As this excess of mortality might be quoted as evidence against the possible colonisation of some of the healthiest of our Indian hill stations, I purpose to examine the facts somewhat closely and critically. Seeing the source from which these children are derived, it would, I think, have been surprising if the death-rate among them had approached, much less equalled, that of the children at corresponding ages in the United Kingdom. Now, what is the exact nature of the source of supply? If you will favour me by referring to Statement 17, showing the mortality among the children of the European army of India, at page 66, vol. ii, New Series, of the *Transactions* of this Society, you will find that they are derived from some of the enfeebled, malaria-stricken, ill-fed remains of children, who during the first five years of life lost by death 87.49 per thousand in 1877, 135.10 in 1878, 138.03 in 1879, and 116.68 in 1880. I would ask you also to refer to Statements 13 and 15, pp. 65 and 66 of the same volume, embracing a period of ten years, ending 1880, where it is shown that, out of an average mortality of 67,864 per annum, 29.726 per *mille* of the deaths were caused by febris intermittens, febris remittens et continua, dysenteria, diarrhœa, cholera, splenitis, hepatitis, atrophia et anæmia; whilst 24.228 succumbed from tubercular disease, heat asphyxia, meningitis and hydrocephalus, convulsions and dentition, leaving a balance of 13.910 from other diseases.

Judged, therefore, by the light of these revelations, the wonder is not so much that, between the ages of five to ten, the death-rate among the children of the Lawrence Asylums should have been nearly twice as high as among the children of corresponding ages in the United Kingdom, and 1.2 per *mille* higher in the period from ten to fifteen, but that it has not been higher still. The relation—nay, the direct dependency—of the high death-rate during the first quin-

quennium upon the diseases contracted on the plains before transfer to the hills is, therefore, in every way probable, and in no way ascribable to the climate of the hills, as might be inferred from the naked and unexplained figures, as given in the Report of the Sanitary Commissioner with the Government of India for 1881. My reading of the results there recorded is that, whilst the increased mortality during the first period is due to prior disease or vital debility contracted on the plains, the low rate during the second period is attributable solely to the conservative and sanitary excellences of the Asylums at Ootacamund, Abu, Sunawur, and Murree. And I have no doubt but that, if the Sanitary Commissioner would, in a future review of the subject, give the vital statistics of the children, showing the diseases causing the deaths for each year separately, from five to fifteen inclusive, this reading would be conclusively confirmed. It would also, I believe, judging from experience of the influence of the hills in adults and children, show that many children are sent to these stations who are suffering from visceral ailments not remediable by residence thereat. Many of these might, however, be saved by early transfer to this country. The sea voyage would be an important means of facilitating convalescence in such cases.

I take it, therefore, that the figures quoted, when carefully criticised and appraised, afford grounds rather in favour of than against the practicability of colonising hill stations removed above the altitude at which malaria is generated, and which possess a climate sufficiently temperate to render outdoor work health giving and health preserving. If this be so, they point to the necessity for careful selection of the children drafted to the Lawrence Asylums, those only being sent who are free from organic disease of a serious character, the disqualified remainder being transferred at suitable seasons to England. If such a system were adopted, any difference in the shape of excess in the death-rate that might remain in comparison with that of England would not be assignable so much to residence at the hills as to the source from which the children are recruited, and the effects of the climatic and insanitary conditions with which they were previously surrounded.

"Beyond all cavil, European children," says Dr. Birch, "may be born and brought up in the hills in a state of physical health not inferior to that of those who have been wholly reared in Europe. I have known many such, but unless advantage be taken of some of the excellent institu-

tions which are available, the moral tone is not likely to be of a high order."

Everyone who has visited the Lawrence Asylums must have been impressed with the robust and healthy aspect of the older pupils especially. The same advantageous effects are soon noted in all other children of European parentage, provided they have been free from visceral or organic disease of some of the more important organs when transferred to the hills above malaria range. With proper care, they shake off the tendency to recurrences of climatic fever, and soon begin to exchange the laxity of fibre, pallor, and anæmia of the plains for renewed muscular tonicity, and the ruddy and rosy complexions so familiar to us in this country. This is particularly the case at the Sub-Himalayan sanitaria—Murree, Simla, Kussowlie, Chakrata, Mussoorie, Landour, Ranikhet, Naine Tal, and Darjeeling, varying, as regards north latitude, from 25 deg. 15 min. 58 sec. to 33 deg. 40 min. These stations have, in addition to the cooling influence of altitude, clouds, the south-west monsoon, rain of local origin, and radiation moderating the summer temperature, a northern distance from the equator and a proximity to the snowy range which combine to produce a winter and spring extending over a period of eight months, accompanied in most of the wintry months by some frost and snow. The climate, in fact, is temperate, and differs from other similar inland climates of lower elevation in more northern latitudes mainly in the proportion of rarefaction of the atmosphere and diminished air pressure due to altitude. In all, water of great purity may be secured with ordinary precautions. In many, land might be obtained for the settlement of Europeans. The Neilgherries possess all these advantages, with the exception of distance, about 11 deg. from the equator, and consequent freedom from frost and snow. This position renders the protection of headgear a necessity in April and May. Still, the planters—who are out all day in all weathers—and their families enjoy excellent health. Water abounds, and is of excellent quality.

It seems to me that the difficulties of colonisation in most of these mountain ranges are political rather than climatic; but they are probably not insuperable. The experiment on a sufficiently large scale to determine the practicability of colonising these hill tracts has not yet, so far as I know, been made. Hitherto, they have simply been used for temporary resort, generally to conserve health, or overcome the ills and enervating effects of residence in the comparatively unhealthy and malarious provinces of the plains, and, in a few cases, by retired officers. As far as one can judge from their climates,

considered with reference to barometric pressure, temperature, rainfall, and the cycle of the seasons of spring, summer, autumn, and winter, their freedom from malarial and epidemic diseases, and their marked beneficial influence in preserving the health of European men, women, and children, and in contributing to its restoration in those suffering from functional disorders of climatic origin, the inference is that, if undertaken in suitable places, their colonisation by Europeans is probably not impracticable.

For the present, and until the question has been fairly and thoroughly tested by settlements of pure Europeans imported direct from the mother country, it is premature, I contend, to condemn the hill tracts of the Sub-Himalayas above fever range as incapable of colonisation. It has often been suggested that the retired soldiers of the British army might be encouraged to settle in these regions, partly for their own benefit, but chiefly that they might be the means of raising a loyal people, whose interests would be bound up in maintaining the prestige and power of the existing Government. But it is manifest that, though this plan would be useful to the Government in the manner indicated, it would scarcely be an infallible test, inasmuch as the parents and children on transfer would be heavily handicapped by constitutions impaired by previous residence in the plains, not to mention the frequent native alliances which would vitiate the experiment.

The Government of India have undertaken many experiments of a mixed commercial and agricultural character, some of which have been eminently successful. Of these, it will suffice for my immediate purpose to mention the cultivation of tea and cinchona. Would it be more difficult to attempt, by way of a small experiment at first, the transplantation and cultivation of that branch of the human family to which we belong on some one or other of the healthiest lands of the Sub-Himalayas, situated high enough to be above the altitude at which malaria is generated? The discovery of gold would soon settle the question without the intervention of the Government. In either case, it cannot be doubted that, if the experiment succeeded, the results, as they became expanded with the lapse of time, would proportionately conduce to the stability and permanence of our rule in India, and lessen to a certain extent the necessity for the drain—now constantly demanded—of recruits from this country.

As cognate to this subject, Surgeon-General J. H. Ker Innes, C.B., writing, in 1877 (vide *Army Medical Blue Book*

for 1878, p. 293), on enteric fever, makes a very pertinent suggestion, viz., that "a practical experiment be made by way of testing the effect of hill stations on the health of newly arrived corps. Let a small station such as Chakrata, for example, be selected, to which a regiment should at once proceed on its arrival at Bombay in the winter season. Provide good water-supply, and ensure that its purity is maintained, and see that the conservancy, drainage, washing, and cooking arrangements are as good as they can be; enlist the co-operation of the commanding and other officers in carrying out the experiment, by explaining to them the object of it, and place the corps in medical charge of an officer specially selected for his intelligence and practical acquaintance with the fever in question." If, as may be anticipated, such a crucial test proved beyond doubt the protection of the troops, not only in great part from typhoid fever, but almost entirely from the malarial diseases and the sequelæ of their plains, and from the effects of extreme heat, it would go a long way in establishing the feasibility of colonising the hills.

2. *A few Remarks on the Management of Infants in India.* —Much mischief is often inflicted on the newly born by the routine administration of the traditional dose of castor-oil. Yet it is certain that the colostrum of the maternal food is generally sufficient to produce action of the bowels in good time. If oil be given immediately after birth, it does harm by hurrying out of the upper bowels material designed for the nourishment of the infant pending the secretion of a sufficient supply of milk. It is better to trust to the mother's milk, which, though small in amount at first, is generally amply sufficient for all purposes. Thus the bowels are regulated by natural means, and the nutriment lodged in the small intestines digested and assimilated, helping, with the small supply of milk derived from the parent during the first three days of its life, to maintain the animal heat and its nourishment, after which milk in adequate quantity is provided for all its wants. In most cases, no purgative will be needed. If, however, in exceptional cases, the bowels fail to respond, an injection of a couple of drachms of sweet-oil with a little soap, in an ounce or two of tepid water gently thrown into the rectum, will effect the object we have in view, without disturbing the digestive tract. The introduction of the pawn-stalk, as employed by native nurses, or a simple or Castile-soap suppository morning and evening, will answer. Even these simple measures should not be had recourse to until nature has had time to evacuate the bowels without the adoption of artificial assistance.

The popular belief that during the first three days the mother cannot supply enough food is a mistake. Nature has provided for the limited quantity during that period by supplementing it with abundance of nutriment stored in the small intestines in almost all cases where the child has been born at the full time. The exceptions are in premature births, or where the mothers are impoverished and unhealthy, or where the mammæ are imperfectly developed, under any of which circumstances the nutritive matter in the intestinal canal of the infant at birth, and that furnished in the breasts of the mother, are deficient in quantity and quality. In these cases, the selection of such food as the infant can digest without difficulty is a matter of the greatest moment. The child may be fed, for the first two or three days, on donkey's or cow's milk; the former diluted with two, the latter with three, parts of water, sweetened with sugar of milk or grape sugar every two or three hours during the day, and every four hours during the night, the quantity given to be regulated by that which has been consumed at the first or second time of feeding. If, under this management, the bowels remain inactive up to the second day, the aperient measures indicated may be had recourse to, and repeated according to circumstances; but on no account ought any medicine to be given by the mouth at this period stronger than a teaspoonful or two of lime-water, or a pinch or two of magnesia, to correct any inconvenient acidity that may exist. A good healthy wet-nurse should now be secured, and care should be taken that she may not have been suckling long—the earlier after the birth of her own child the better for her foster-child. It should be noted that the milk of a wet-nurse is too strong, rich, and heavy for its tender stomach for the first seventy-two hours or so. This method is equally applicable for an infant of full growth, whose mother, from whatever cause, is deemed to be unfit to suckle it. If, however, the wet-nurse be employed from the commencement, care should be taken that it is only allowed to draw a limited quantity of milk for the first three days, the surplus being artificially drawn off. If these instructions are adopted, it will seldom be necessary to have recourse to aperients, by the mouth at least.

Most of the disordered digestion, flatulency, griping, vomiting, constipation, or relaxed bowels in infants during suckling, are traceable to errors in feeding. And instead of correcting these by regulating the quantity and quality of their food, they are dosed, often most unmercifully, with mineral and other purgatives, whilst pain and the consequent restlessness

and sleeplessness are subdued by the exhibition of opiates. Thus, the mercurial preparations, grey powder or calomel in various combinations, are given as purgatives, whilst Dalby's carminative or Godfrey's cordial, both of which contain opium, is administered for the relief of pain. It is impossible to over-estimate the injury which is being unconsciously, and with the best intention, no doubt, inflicted by this antiquated nursery practice. *First*, the digestive system is overtaxed and deranged by excessive and improper feeding. *Secondly*, an endeavour is made to rectify matters by a resort to mercurial or other purgatives. *Thirdly*, the discomfort and pain which result from these and bad feeding are temporarily relieved by the exhibition of one or other of the quack preparations of opium. Even in the hands of the physician, such drugs have to be employed with the greatest care, owing to the special dangers attending their administration to infants and children.

In all countries, most of the large amount of preventable mortality among infants and young children is directly ascribable to improper feeding and the meddlesome practice of the nursery. Nowhere is the truth of this statement more lamentably confirmed than by the statistics of infant and child mortality in India, as may be observed by a glance at the columns of the subjoined table, showing the mortality per thousand of the living among the children of the European army of India, at certain ages, during 1877, 1878, 1879, and 1880.

Age.	1877.	1878.	1879.	1880.
Under 6 months	244.65	293.39	319.63	290.73
Between 6 months and 1 year	158.73	218.75	216.98	210.31
„ 12 „ 18 months	137.45	210.00	245.16	181.61
„ 18 „ 2 years	55.87	141.59	103.26	94.66
„ 2 years and 3 „	45.63	71.58	118.75	55.72
„ 3 „ 4 „	18.34	39.34	36.27	51.45
„ 4 „ 5 „	16.72	23.28	40.71	32.47
„ 5 „ 6 „	14.98	18.82	24.96	12.84
„ 6 „ 7 „	7.65	15.09	15.67	17.11
„ 7 „ 15 „ etc....	8.19	11.23	11.58	7.62

That much of the milk supplied by the mothers is unfit for the nourishment of their infants, may be inferred from the very high mortality of the child-bearing women of the army of India between the ages of 17 to 30, and is demonstrated by the death-rate per thousand among them during the same period. Thus—

In 1877 it amounted to		22.50	per *mille.*
„ 1878	„	29.20	„
„ 1879	„	25.00	„
„ 1880	„	21.05	„

As a general rule, the child should be put to the breast soon after it is born, with a view to stimulate the secretion of milk, draw out and elongate the nipple, develop the power of suction, and promote uterine contraction. Arrowroot, barley water, and other kinds of starchy or farinaceous food, should be religiously avoided until the teeth begin to emerge from the gums. Before this, or the sixth or seventh month, the juices of the salivary and pancreatic glands, owing to their imperfect development and growth, are too scanty in quantity and poor in quality to dispose of such starchy aliment. After the child has cut its incisors, these farinaceous articles may be given with propriety, should the natural supply appear insufficient.

When the mother's milk fails, a wet-nurse is the best substitute. Her age should correspond as nearly as possible with that of the mother, and so ought the period of lactation as to time, and she should not be younger than seventeen nor older than thirty. For, in nine cases out of ten, recourse must be had to native women, who bear children at an early age, and cease to do so proportionately early. She should have a smooth, sleek, and healthy skin, free from eruptions and marks of specific disease of an enthetic character; a well-formed and well-nourished frame, devoid of any traces of a ricketty nature; a clear eye; clean tongue; good appetite; and plump, full, and firm breasts with sound nipples, of adequate size and length. On the nipples being gently compressed the milk should flow out freely, be of a bluish colour, and yield a generous cream on being collected in quantity and allowed to cool in the open air. She should be temperate as regards food, drink, and smoking; of fair intellectual power, continent, moral, and of a calm, placid, and equable temperament. If the selection be made without medical advice, care must be taken that no deception is being practised. It is not difficult for a lactating woman to present all the outward appearance of mammæ well stored with milk, at the time of examination, when in reality the aggregate secreted in the twenty-four hours is altogether insufficient. This is simply done by the imbibition of a large quantity of liquid, and allowing the milk to accumulate over many hours before inspection. By having the milk drawn off, and keeping the woman under observation for a few hours, to ascertain

whether the breasts become refilled or not, the deception may be readily exposed. The food of the wet-nurse should be of the best quality procurable—in kind and quality—suited to her habits and nationality.

Up to the cutting of the front teeth, the milk of the mother or wet-nurse should, as a rule, constitute the sole dietary of the infant. Nay, almost to the time of weaning, this will often suffice. During the first week, the infant may be fed every two hours in the day, and every four hours at night. Afterwards, it should not be suckled oftener than every four hours during the day; if fed on going to bed, it should not trouble the mother or wet-nurse for at least six hours. The enforcement of this salutary rule requires some firmness on the part of the nurse or mother; and its accomplishment is materially facilitated by so arranging that the infant may always sleep apart, in a separate couch or cot.

When the two lower front teeth have been cut, a little additional food in the shape of arrowroot, sago, pearl barley, soojee, or cornflour may be allowed, whenever the milk of mother or wet-nurse seems to be insufficient. At the ninth or tenth month, provided four teeth have fairly come through, chicken-broth with bread, or fresh broth may be given once in twenty-four hours. When the teeth have all been cut, meat may be allowed for dinner daily. In the warm months, and particularly in the hot winds of the upper provinces, meat should not be given to children oftener than once in two days; and in plethoric children not oftener than twice a week during the summer season.

Failing the milk of the mother or wet-nurse, recourse must often be had to hand feeding with ass's, goat's, cow's, or condensed milk. The composition of these is demonstrated in the subjoined statement:—

Ingredients.	Payen's Analysis.				Werner.
	Human.	Ass's.	Goat's.	Cow's.	Condensed.
Curd or caseine and insoluble salts.	3.35	1.70	4.50	4.55	24.2 to 28.1
Fat, butter, or cream	3.34	1.40	4.10	3.70	12 to 13.6
Lactine, sugar of milk, and soluble salts.	3.77	6.40	5.80	5.35	16.1 to 20.6
Water	89.54	90.50	85.60	86.40	18.8 to 22.4
Cane sugar	...	...	...	...	24 to 30
	100	100	100	100	100

Compared with the milk of the mother, that of the ass is much poorer in curd and butter, and richer in sugar, salts, and water. It is only about half as nourishing as human milk, and most suitable for infants provided with feeble digestive powers. When given in adequate quantity to support nutrition, it is liable to produce looseness, owing to excess of salts in it, which may be corrected by adding to it a fourth part of lime-water. The milk of the goat yields an excess of curd, butter, and saline matters. It should be diluted with three-fourths of water, and sweetened with grape sugar or sugar of milk. Cow's milk is richer in solids than human milk. It is slightly acid, and should be rendered alkaline by adding a sufficiency of lime-water. It should be diluted to the extent of two-thirds, partly with lime-water and partly with water, and sweetened with grape sugar or sugar of milk. Swiss or condensed milk, in the proportion of a teaspoonful to a teacupful of warm water at birth, is very useful on board ship, or when goat's or cow's milk cannot be procured. Infants thrive well upon it. The animal selected should always be purchased, if practicable, well fed on wholesome food, and milked under trustworthy inspection into a vessel kept scrupulously clean.

In hot climates it is especially advisable to have the milk of the ass, goat, or cow boiled as soon as it is drawn. Boiling checks the progress of fermentation, it is said, by destroying the bacterium lactis, whilst it renders the nitrogenous matter more digestible. Any impairment of nutritive value supposed to be occasioned by the escape of volatile elements during boiling, is amply compensated for by the greater purity thus ensured. For this reason, the water used for dilution should have been recently filtered and boiled. After boiling, both the milk and water should be stored in the coolest place available. In the hot weather and rains, ice may be employed to keep the milk at a temperature below 60 deg.

Each meal should be given tepid, or at a temperature of 96 deg. to 98 deg. Fahr., by means of a feeding-bottle provided with a nipple of vulcanised india-rubber, chamois leather, calf's teat, or cork; for the sucking exercises the oral and buccal muscles, causes the flow of saliva, and assists digestion. The times of feeding should be the same as those laid down for the guidance of the suckling mother or wet-nurse; the food is strengthened as the child grows older, by diminishing the dilution with water, and later on by an additional quantity of milk. The amount required for each meal is determined by noting the quantity

at first swallowed to produce satiety. And from time to time, as the age increases and the demands of the system become greater, the same method should be adopted for adjusting the quantity for each meal. If this careful regulation of the meals be neglected, there is a risk of over-feeding, or overloading the stomach, which is certain, especially when it becomes habitual, to produce indigestion, deranged assimilation, imperfect nutrition, eructations, vomiting, griping, diarrhœa, restlessness and sleeplessness, loss of condition, emaciation, etc.

The British feeding-bottle may be used. It can be easily cleansed. The flow of the milk can be quickened or retarded at pleasure, to simulate the slow and gradual issue of the milk from the mother's breast during the process of suckling—a point of considerable importance, whilst there is no fear of air being drawn in with it; and it can be placed in any position without the occurrence of overflow or the soiling of the clothes. It should always be carefully cleansed and purified whenever it has been used. Neglect of this precaution leads to its becoming foul, a condition which is rapidly communicated to its contents, and which cannot but prove injurious to the delicate digestive system of the child. The mouth-piece should be well secured to prevent accident, as instances have occurred where, during suckling, it has become detached and been swallowed.

In cases suffering from the symptoms of over-feeding, above referred to, which are generally attributed by the parent to hunger, because the infant seems to crave for food, when restlessly awake, or writhing from flatulent distension or griping, a cure may be effected in almost all cases where there is no inherent and radical defect inherited or acquired, simply by the proper regulation and adjustment of food without the aid of medicine. The amount of milk must be diminished, and what is allowed must be given in a more digestible form, or more diluted with water, and at longer intervals. The result is the cessation of the vomiting of sour, curdled milk, or of its appearance in the stools, and the simultaneous restoration of the processes of digestion and assimilation.

In aggravated cases, where the overloading of the stomach has been of long duration, and the derangement of the digestion with diarrhœa has become so serious as to produce flabbiness of the muscular system and emaciation, it may even become necessary to substitute, for the ordinary diluted allowance, one, two, or more meals during the day,

consisting chiefly of water mixed with a quarter of a tea-spoonful of sugar, a dessert-spoonful of the milk of the animal upon which it is being artificially fed, with a dessert-spoonful of lime-water. It is only in exceptional cases that this regimen may require to be prefaced by a dose of castor-oil.

It cannot, however, be too prominently stated that, in nineteen cases out of twenty, or even in greater proportion, the digestive powers of the infant can be completely restored by proper regulation of the food alone. By this management the needful rest is given to the overworked and over-taxed stomach, to enable it to regain strength and tone, and so to become fitted to secrete gastric juice sufficient in quantity and quality for the solution or digestion of the alimentary principles of the milk. When such improvement has been secured, the ordinary diet may be resumed; care being taken, if necessary, either by dilution of the milk or by lengthening the intervals between the meals, to measure the aggregate quantity of nutritive matter allowed in the twenty-four hours to the standard capacity of the infant, to utilise it without suffering from morbid symptoms of any kind.

Owing to the malariousness, heat, and relaxing nature of the climate of the plains, the number of English and East Indian mothers unable, or only partially able, to nurse their children is unfortunately very large. In the latter case, the question will often arise whether supplemental hand-feeding or a wet-nurse should be provided. It is manifest that the mother is unequal to the task nature intended to impose upon her, and the sooner this fact is recognised and acted upon, the better for her and her offspring. For there is good reason to believe that, whenever the milk at the beginning of lactation or nursing is inadequate in quantity, it is in reality poor in quality, and unsuited for the nourishment of the child. The best plan is, therefore, to secure the services of a wet-nurse. If, however, this is impracticable, partial nursing and hand-feeding may be combined, so long as the parent's health stands tolerably firm.

The malted foods first introduced by Liebig have been vastly improved of late years. In the best of them, the starchy component is wholly converted into grape sugar, whilst the phosphates are contained in sufficient quantity. An adequate proportion of cow's milk, and, it may be, of cream, lime-water, or saccharated solution of lime, must be employed, so that the nutritive fat and heat producing elements may be fully represented in an easily digestible and assimilable form. Thus arranged, Chapman's Entire Wheat Flour, or Mellin's

Food, may be used to supplement the defective supply of mother or wet-nurse, and for the nourishment of delicate, hand-fed infants who cannot digest cow's milk diluted and prepared in the ordinary way; and in such cases they may be commenced as early as the third month, or even from birth when necessary. They are also important aids to weaning. But it cannot be too strongly urged that none of these malted foods are capable of maintaining general nutrition alone, and that they must be assisted in the manner already pointed out.

There is much difference of opinion as to the best time for weaning the infant. When it is strong and vigorous, this change may be effected from the ninth to the twelfth, and when it is weakly and backward, it may be postponed till the sixteenth and seventeenth month. As a general rule, after it has cut the first grinders, or about the twelfth or fourteenth month, it is wise to wean it. Too early weaning, before the eighth or ninth month, is often injurious to the health of the child. No hard-and-fast rule for all cases can be laid down. But it is clear that, in the cases of delicate children, when the mother or wet-nurse is robust, the period of suckling may be extended with advantage; whilst in cases where the child is strong, and the parent or nurse weakly, the period may be judiciously curtailed. When the child has been weaned too early, either from necessity or choice, and consequent symptoms of disordered digestion, bowel complaints, convulsions, etc., supervene, perhaps the best plan is to engage a wet-nurse without delay.

It sometimes happens that the milk of one woman disagrees, when that of another will restore it to health. If the infant declines to resume suckling, recourse must be had to artificial feeding, and, under these circumstances, nothing is better than donkey's milk, of which a quarter to half a pint, with or without a teaspoonful of lime-water, should be given three or four times a day, or oftener if necessary. The lives of hundreds of children, otherwise hopeless, have been saved by this simple management.

Weaning should be gradually accomplished. On the cutting of the first teeth, the way may be paved by giving ass's, goat's, or cow's milk diluted as previously directed; and as more teeth appear, thoroughly well-boiled arrowroot, rice, pearl barley, or cornflour may be added; or, later, these may be alternated with broth, beef tea, or Liebig's essences of chicken, mutton, or beef, the supply of the mother's milk being meanwhile proportionately diminished.

It should be borne in mind that after weaning the stomach

of the child is still imperfectly developed. Its food must, therefore, for some time be of a liquid or semi-liquid consistency, and easily digestible, such as cow's or goat's milk, with arrowroot, sago, pearl barley, rice, cornflour, soojee, chicken or mutton broth, beef tea, biscuit, tops and bottoms reduced to a semi-liquid form by soaking in boiling water, or simply milk, sago, and isinglass water. Churchill's bread jelly, prepared as follows, is highly recommended:—The soft part of bread is broken up, and allowed to soak for some time in boiling water, which is strained off. Fresh water is added, and the whole boiled until it becomes uniformly mixed and smooth. This water is drained off. The residue is a firm bread jelly, a portion of which is mixed with milk or water and sugar for use as it is wanted (Tanner).

We learn from the same authority that the "carrot pap" of Dr. Grumpecht of Hamburg is also in great repute. "An ounce of finely-scraped, full-grown carrot is to be mixed with two cupfuls of cold soft water, and allowed to stand for twelve hours. The fluid portion is then to be strained off, that which remains being pressed to yield as much as possible. This fluid is then to be mixed with the proper quantity of biscuit powder, bruised crust of bread, or arrowroot, and the pap placed over a slow fire until it begins to bubble, care being taken that the heating be not pushed so far as to cause boiling, or the albumen will coagulate. After removal from the fire, it is to be sweetened, and thus is formed a most nourishing, agreeable pap, the use of which is only contra-indicated by any tendency to diarrhœa." Dr. Grumpecht states that, "by mixing carrot-juice with biscuit, crust of bread, arrowroot, and sugar, we obtain all the nutritious elements required, viz., albumen, gluten, starch, sugar, fat, and the phosphates of lime and magnesia". Dhal and rice, well cooked and prepared with a minimum of seasoning, will be found to be wholesome and useful a few months after weaning.

When the whole of the milk teeth have been cut, the child must be fed on more solid and nutritious food, such as bread, biscuit and milk, soups, eggs, light puddings, vegetables, white fish, chicken, lamb, mutton, light pastry, cakes, sweets, fresh ripe fruit, etc. If each meal be confined to one plain dish, or to two at dinner, overfeeding will generally be avoided. The number of meals should not exceed four daily, given with regularity, allowing eight or nine hours for sleep at night. The objections which apply in the case of adults to the mid-day sleep are not tenable in that of growing children. Two meals before and two after the siesta will answer admirably.

The clothing, exercise, and bathing should be carefully attended to, so as to protect the surface from chill and promote healthy function on the part of the prime organs, invigorate the nervous and muscular systems, and maintain the utmost cleanliness. The temperature of the water for bathing should be 90 deg. to 95 deg. Fahr. in the cold weather, and 80 deg. to 85 deg. in the summer months. In some delicate children, a bath containing half-a-pound of Tidman's Sea Salt in four gallons of water is highly useful, but sea water is preferable, whenever it can be obtained. In India, the infant should be washed all over at least twice a day.

Those parts which are liable to chafe from the natural delicacy of the skin, the collection of the products of the perspiration and friction—the bends of the elbows and knees, armpits, clefts of the nates, behind the ears, folds below chin and jaws, etc., and the neighbourhood of the anus and genitals, should receive special attention, and be daubed over with puff or violet powder after washing, or the bath.

Every child should be vaccinated within three months after birth, if possible. In Calcutta and its environs, throughout Bengal Proper, at all the hill stations, and in many other parts of India, vaccination is successfully practised all the year round. But in those parts of Upper India, when the hot winds prevail, it is difficult to vaccinate from child to child, a plan which should be adopted whenever practicable. Here it is best performed from November to March. It is quite safe to vaccinate fairly healthy infants after they are a month old, and even earlier, under urgent circumstances.

Dentition being simply a process of development and growth, ought not, in a healthy child, born of healthy parents and carefully suckled and reared, to be attended with difficulty. So many European children, however, in India, are, from causes already adverted to, originally endowed with deficient stamina and improperly fed, that the process is frequently accompanied with suffering and danger. The connections existing between the pneumogastric, sympathetic, and the fifth nerves, which latter supply the teeth pulps with nervous material, are so extensive and numerous that functional disturbance of one set or any part of one series is liable to be reflected to, and act upon, the others. Hence, in great part, the association of stomach and other derangements with the cutting of the teeth.

When the teeth appear naturally, and the child is in good health, they emerge from the gums in the following order:—The two lower incisors penetrate the gums between the sixth and seventh month; the corresponding upper incisors in from three weeks to a month afterwards; the two lateral incisors about the eighth or ninth month; the two upper lateral incisors generally soon, or a month, afterwards, but these often precede the lower ones; the anterior molars of the lower jaw about the twelfth or fourteenth month, those of the upper jaw following shortly afterwards; the canine or eye teeth between the sixteenth and twentieth month; and lastly, the second molars between the twentieth and thirtieth or thirty-sixth month—thus completing the cutting of the temporary milk teeth, as a general rule, at the age of two years and a half to three years.

The cutting of any of these teeth may be attended with vomiting, diarrhœa, difficulty in micturition, or convulsions. If, to these conditions, there be an increase of the saliva—trickling from the angles of the mouth, restlessness, flushing of the cheeks, heat of forehead, hands and feet, sleeplessness, loss or capriciousness of appetite, thrusting of the fingers repeatedly into the mouth; and the gum over the expected tooth or teeth be hot, red, swollen, tense, shining and hard, there need be no hesitation in scarifying or lancing the inflamed part. When carefully done, under these circumstances, it may and often does much good: it cannot do harm. Indiscriminate lancing cannot be recommended. But, in appropriate cases, with the local indications here described well pronounced, it very frequently affords speedy, complete, and permanent relief. In milder cases, a small quantity of the mel boracis, made of sixty-four grains of borax to an ounce of honey, and briskly rubbed over the gums two or three times a day, is sufficient.

The causes of the high mortality among soldiers' children in India were given in my paper of last Session, and need not be repeated here. Nor need I allude again at length to the excellent results which have been attained over a long series of years at the European Orphan Asylum at Calcutta. Still more favourable results are obtained among the infants and children of the higher classes of Europeans, up to the period when it is desirable to transfer them to England for education. Bearing upon this point, I here quote the following figures from Dr. Hugh Macpherson's paper on European infant mortality in Calcutta:—

Ages.	Calcutta. 1,568.	European Rate.
Under 1 year	54.7	55.7
1 to 2 years.....	23.9	20.2
2 to 3 „	10.6	11.2
3 to 4 „	5.4	7.4
4 to 5 „	5.19	5.2

"The table," says Dr. Macpherson, "proves this much at least, that of all who die under five years, the casualties at the earliest period are quite as few here as in Europe. The differences are trifling, and the results shown, if corroborated by further observation, would indicate that the season of teething is slightly more trying to children in India, but before and after that period they thrive at least as well in India as in Europe up to five years." Dr. Payne's more recent investigation appears at first sight to confirm this conclusion. But I would submit that the facts are vitiated by a serious fallacy which has escaped observation. Thus, the deaths occurred among the children of parents occupying in Calcutta, with few exceptions, the position of the higher portion of the middle class in this country, whilst the death-rate at home is calculated from the infantile mortality occurring among all classes of the population, high and low. A comparison has, therefore, been made between things not fairly comparable. If a comparison could be made between the death-rate of the children of Europeans in Calcutta, and that of the children of a corresponding class in England, the result would probably show that the conclusions hitherto accepted are, in a large measure, unsupported by the facts, and quite untenable. Be this, however, as it may, it is patent that,—after the weaning process has been accomplished, notwithstanding the many advantages of a comparatively open-air life, for they are reared in roomy mansions always pervaded by constant relays of fresh air, have the best nursing, maternal and medical care, and enjoy immunity from several of the infantile diseases so fatal in temperate climates—they seldom present the all-round physiological tone, physical robustness, "muscular rotundity, hardness, plumpness, and rosy complexions" of children of the same class in this country. With the utmost care, there is to be noted a certain measure of pallor or anæmia, especially during the hot and rainy seasons, languor or indisposition to exercise, imperfection of appetite, slowness of digestion, undue nervous excitability, relaxation of the muscular and fibrous structures, looseness, extraordinary flexibility of the joints, and, as Martin observes, a

tendency in some "to lateral curvature of the spine." "But, although most physicians must perceive that European children would be better at home, the necessities of parents, the exemption from some serious infantile complaints, and their fairly healthy condition, have partially reconciled the parents and their medical attendants to sanction their temporary retention in India" (*Book of Health*, p. 954, art. by Sir Joseph Fayrer and J. Ewart).

These conditions are favourably modified if it be possible to send them to the hills during the summer, rains, and drying-up months. European children intended to fight their way, in the professions or commerce, should be located in the hills, as early after weaning as possible, during the hot and sickly seasons, and their transfer to the mother country should not be deferred beyond the fifth or sixth year. Even before this age they have been noticed to shoot up too fast, become thin and indolent, irritable, lanky, and lean. For children of this class, residence at the hills suffices to maintain physical vigour; but does not, so far as I know, afford the means of conferring that high standard of intellectual training absolutely necessary to success, in these days of competition, in the careers afterwards selected for them.

Another question of some moment is often presented. Should European children born in England be taken to India? If suckling, they may be, but it would be better to have the process completed at home, and then to leave them here under proper custody, unless provision can be made for their passing the hot, rainy, and autumn seasons, or, what is still better, the whole of the ante-educational period of childhood, in the hills.

The European children destined to be reared in India, and to pass the remainder of their lives there, should, whenever practicable, be sent, as early as may be, to be brought up in the hills. There the climate is temperate and healthy enough, and the schools sufficiently good to enable them to develop a *mens sana in corpore sano*, and to fit them for the positions in life selected by, or for, them. For those who cannot, for pecuniary reasons, have these advantages, it is a consolation to know, on the authority of Sir Joseph Fayrer and others, that, up to a certain point, their physical and intellectual training may, in institutions conducted on the principles prevailing at the European Orphan Asylum at Calcutta, be secured with considerable success. But anything short of these must be attended with corresponding failure. It is, however, melancholy to reflect that, though this generation

may flourish, ultimate extinction of their progeny looms in the no distant future—no further off than, according to our present knowledge, the third or the fourth generation.

In conclusion, I may say that I am deeply sensible of the imperfect manner in which the questions embraced in this communication have been considered. It could scarcely be otherwise in the compass of a single paper, restricted as to time and space. Of one thing I am certain, and that is, that their decisive treatment is of vast importance. Every step in advance calculated to save the lives and promote the health and longevity of the European children reared in the plains of India, and to settle the question of the colonisation of the hills in the affirmative, must result not only in increasing the happiness and prosperity of the people concerned, but in augmenting the stability and civilising influence of our rule over an Empire continental in area and population—extending, as it does, upwards of nineteen hundred miles at its longest and broadest parts,—from Peshawar to Cape Comorin, and from Rangoon to Bombay,—and comprising 252,341,210 persons.

Regarding the subject of colonisation, it must not be considered that much more has been done than to touch upon, or suggest, points of interest for future observers, which, although they have already engaged the earnest attention of distinguished predecessors and contemporaries, have not as yet been finally exhausted.

EPIDEMIOLOGICAL NOTES DURING THE AUTUMN OF 1883 IN BEYROUT, SYRIA.

By JOHN WORTABET, M.D.,

Physician to the Hospital of the Knights of St. John.

(*Read: June 11th*, 1884.)

In August 1883, it was reported from Latakia, a town on the northern coast of Syria, that they had an epidemic of dengue fever, which soon became so universal that very few escaped it. How it came there, or whether it originated on the spot from some local causes, seems to be unknown. From the fact that it was not heard of before in any other place which would account for its importation, it seems that we must take the latter view, and believe that it arose there *ab novo* from some "climatic state" or "atmospheric change", which the ancient physicians attributed either to telluric exhalations, or to some intrinsic change in the water held by the atmosphere itself, which is caused by some unnatural condition of the season, and which they called by the general name of "the constitution of the seasons". Having once originated, it seemed to spread to neighbouring places by importation, as the sequel will show.

It appeared in Beyrout about the beginning of September, and in two or three weeks spread through the whole town. In October it had become so universal that very few escaped it. During the summer, many—probably not less than one-third—of the inhabitants of Beyrout had gone up to the villages of the Lebanon, either for change of air, the cooler atmosphere, or fear of an outbreak of cholera in the plains. As they returned in October most of them took it. In the beginning of November we had a heavy storm of rain, with much lightning and thunder, which continued two days, and which did not appear to have any sensible effect on the epidemic, the disease still picking up persons who had previously escaped. On the 20th of the same month there was another heavy fall of rain, which lasted some days; but there were fresh occurrences of the fever lingering through the whole month of December.

From Beyrout the epidemic was propagated to all the neighbouring villages at the base of the Lebanon, where it spread very much among the inhabitants; but it did not go up to any place higher than 2,000 feet above the level of the sea, except in the case of persons who took it with them, and from whom it was not generally communicated to others. Like cholera, it seems to find no favourable soil for its extension in the high and dry air of the mountains. It spread also northward as far as Batrum (the ancient Botrys, a small town on the coast between Beyrout and Tripoli), and southward to Sidon, from which place it spread also to the low villages on the adjacent hills. In Sidon the disease was so widely diffused at one time, that, when a death occurred in the town, the burial could be attended to only with much difficulty. I have no certain information as to how far south the epidemic went, but I believe it reached Tyre and Acre.

The former visitations of dengue, as far as they have been noticed in Syria and neighbouring parts of the East, and as far as I have been able to find out, are as follows:—It appeared in Syria for the first time in 1861, when it seems to have been as universal in Beyrout as it was this year; and again in 1865, 1867, and now in 1883. It is said to have visited Cairo in 1845, Port Said in September and October 1871, Ismailieh, November 1877, Cairo and other parts of the Delta in September, and increasing in intensity about the beginning of October, when humidity is at its height in Lower Egypt. I am not aware that it has ever appeared in the highly dry atmosphere of Upper Egypt, a fact which, taken with others, would confirm the view that moisture in the air is a favourable, if not an essential, condition for the propagation of dengue fever.

An epidemic of what now appears to have been evidently dengue fever, prevailed over all Malta and Gozo in the autumn of 1878. The mode of invasion, the symptoms of the disease, its short duration, the eruption, and the subsequent debility, mentioned in the printed report of a Commission of medical men to the Government, leave hardly any doubt as to the nature of the epidemic. By a strange oversight, it was not then recognised. It was probably brought from India with some ship, though the Medical Commission did not believe that it was contagious, and supposed that it owed its origin "to local conditions or to a pandemic wave". A heavy fall of rain in the first part of September, followed by a protracted and excessive heat and *moisture*, and the prevalence of scirocco, they thought, materially contributed to the diffusion of the disease.

The epidemic in Beyrout was almost absolutely universal. All the physicians of the town, with a single exception, had it, myself sharing the general fate. The premonitory symptoms, when the disease was not ushered in suddenly, were general lassitude and a falling off of the appetite for two or three days. The actual invasion usually began with a chill and fever, severe pains in the limbs, chiefly in the back and knees, frequent and full pulse, sleeplessness, and a coated tongue, with a very bad taste in the mouth. This continued generally from three to four days, when a red eruption appeared on the whole body, sometimes involving the face. On the appearance of the eruption the fever generally subsided, and the patient was considered convalescent, though there was sometimes a slight rise of the temperature about the sixth day which was generally unnoticed. The convalescence was usually accompanied by much weakness, and this was protracted for some weeks in elderly or debilitated subjects. In a few instances there was a real relapse of most of the symptoms of the first invasion, though in a milder degree, and probably without the eruption.

In looking a little more closely to the main symptoms of the disease, we have the following observations to make.

1. The articular *pain* which has given this fever its special name, *Dengue*, a Spanish translation of the word *dandy*, by which it was called among the negroes of the West Indies, both words signifying a stiff gait in walking; in Syria it early received the name of "knee-fever"; and in America it was called "breakbone fever". All these names point to the pain, which affects chiefly the knees and lumbar portion of the spinal column, and which is quite characteristic of this disease. I have never seen any swelling of the joints, though they are said to be sometimes swollen and hot. Pain in the head was very frequent, specially during the first day of the fever, and often accompanied by severe pain in rolling the eyeballs upwards or pressing them with the finger.

2. The *fever* generally continued from three to five days. Sometimes it and the other symptoms were so mild that the patient did not keep his bed, and occasionally it exceeded the fifth day, and the case was severer than usual. I had the temperature taken carefully in six cases in the hospital, morning and night, and it varied between 37.5 C. and 40.2 C., most generally a little higher in the forenoon than in the afternoon. It is said that in the dengue fever of India, after the subsidence of the fever about the third or fourth day, there is generally another rise of the temperature about the

sixth day; but this appears to have been rarely so in the Syrian epidemic. In only one of the hospital cases did I observe this rise. Private patients could not be watched so easily, as they left their beds or houses as soon as they got better, and considered the ailment as too trivial and short to need much attention.

3. The *eruption* came out over the whole body generally about the third or fourth day. In some cases it did not appear at all; in others it was the chief symptom in recognising the disease. When it came out well it was generally supposed to indicate the complete subsidence of the disease, and the same critical relation of the eruption to the fever has been always held by the common people as true in the other exanthemata; but while this seems to be true in most cases, it is not so in every instance. The eruption was not of one kind, it was generally papillary, like that of measles, slightly raised above the skin; sometimes it had a mottled appearance without any elevation, and occasionally there was an erythematous blush like that of scarlatina. In every case the colour was more or less red. It was often attended by a pricking sensation, and ended by desquamation. The general constancy of the eruption and its appearance at a certain stage of the fever, followed by a decline of the symptoms, clearly point to the classification of dengue among the exanthematous fevers.

4. The *digestive functions* were almost invariably impaired to a very unusual degree. The appetite was completely lost, an extremely bad taste was felt in the mouth, and the bowels were always constipated. In a few cases there was much irritability of the alimentary canal, with some vomiting and diarrhœa, which has led a few medical men to suppose that there are two varieties of dengue, called by them the rheumatic and gastric; but this is evidently a mistake, for the gastro-intestinal symptoms were accidental, and were probably owing to a previous bilious state of the system. The same thing may be said of occasional pain in the throat arising from a congested state of its mucous membrane.

5. The epidemic was almost *universal*, sparing no age, from the infant at the breast to men in advanced life; and the same account is given from the other places in Syria which it has visited. But in no case could death be directly traced to it, though in some instances it seems to have stirred up to a fatal result some old or latent disease, or it may have prepared the person for a subsequent and serious illness ending in death. The severest case I saw was accompanied by some delirium and a considerable amount of inflammation of the testicles,

which had to be leeched. In some instances it was attended with sore throat and enlargement of the lymphatic glands of the neck. In one young woman it seems to have produced temporary insanity for a few days. As a general rule, the patient was confined to his bed only two or three days, rallied by his friends for being the victim of knee-fever. Perspiration was always useful in mitigating the febrile symptoms and the attendant pains, but it was never so critical as in intermittent fever.

6. One more point remains to be noticed, and that is the question of the *infectiousness* of dengue. The fact that it spread from an infected centre to the neighbouring towns and villages, as we have shown in the early part of this paper, and that when it came into a family it attacked all its members, with hardly an exception, one after the other in the course of a few days, points very strongly to the belief that dengue fever is the most infectious of all diseases. I know hardly any instance in which there was exposure to it during its height of prevalence without the person succumbing to its influence of communicability. Mothers and nurses gave it to the youngest infants, who, with fever, had the characteristic eruption. Sir W. R. E. Smart, who has extensively studied a number of its visitations, and given a detailed account of them, says: "In the whole of this wide dissemination there was sufficient evidence of its infectious, if not of its contagious properties." (*Trans. of the Epidemiological Society of London*, Vol. IV, Part I.) The medium of infection seems to be more the air than contaminated water, but what this "contagium vivum" is, I could not discover. The examination of the blood by the microscope during the fever revealed no disease-germs, though there was an alteration in the form of the corpuscles. The exposure of every one was so great and so constant that it is difficult to say what the period of *incubation* was. A few cases, who took the infection with them to the mountain villages, which were free from the disease, and did not fall ill before the tenth day after their arrival, would show that this was the utmost limit, though the usual time was probably not much more than two or three days.

I have already stated that the epidemic in Beyrout began in September and ended in December, its height being in October, and from the history of former visitations, and the fact that it has been hitherto limited to tropical and southern latitudes, viz., India, the West Indies, Brazil, the southern United States, Egypt and Syria, Zanzibar, and once Malta, and that at no time did it spread in villages of the Lebanon higher than 2,000 feet, where the air is cool and dry, it would

appear that the most favourable, if not essential, condition for its importation and extension is a warm and moist climate. This will probably explain why Europe, with the exception of Spain, has been spared a visitation from the eruptive fever.

SOME OBSERVATIONS ON THE ETIOLOG
DIPHTHERIA.

By H. FRANKLIN PARSONS, M.D.

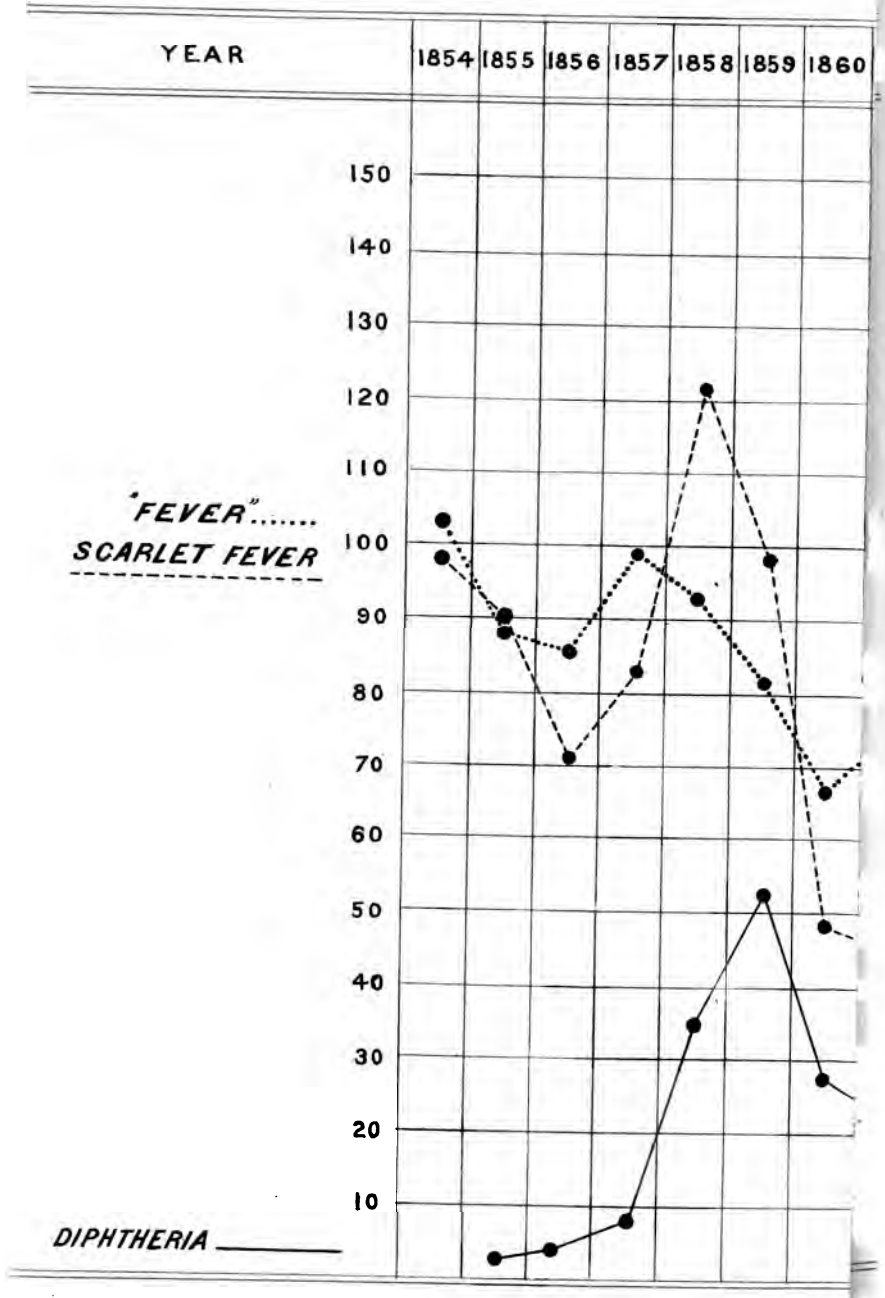
(*Read: June 11th*, 1884.)

THE mode of causation of diphtheria is one of the
problems of medicine, or, at any rate, one of w
general or complete solution has as yet been given.
offering this paper do I make any profession of havi
such a solution; my object is rather to bring toge
facts known concerning the causation of the disease,
with some of the hypotheses which have been fr
to time propounded to explain them, supplemented
observations of my own, in the hope of affordin
which may serve for a profitable discussion of the su

Although the name of diphtheria (*διφθέρα*, leather
of the present century, having been first used by Bre
in 1821, the disease itself has been known from ve
times under other names, such as Malum Ægy
angina, cynanche maligna, putrid sore-throat, etc.
extensively prevalent in England in the middle of
century; but during the latter part of that century
first half of the present, although epidemic in Fra
other continental countries, it appears to have been
in this country only in the form of sporadic ca
occasional limited outbreaks. A considerable
occurred at Haverfordwest in 1849; and several in
parts of England in 1855, from which time to the
the disease has been continually with us. It was
grouped with scarlet fever by the Registrar-Gener
table in his thirty-second annual report enables the re
mortality from the disease to be separately give
back as 1855. The subsequent history of the di
traced in the accompanying diagram; the curves fo
fever and continued fevers being also given, for
comparison.

It will be seen that the disease, as measured by th
tered mortality, rose rapidly until it reached its cli
per 100,000, in 1859, after which it declined. A

ENGLAND AND WALES:— Dec



lesser rise took place in 1863, and then the mortality steadily subsided until it reached 12 per 100,000 living; and it has remained at or about that point, with comparatively trifling fluctuations, ever since. In recent years it has shown a tendency to rise.

In reference, however, to the amount of the mortality from diphtheria, the following passage from the forty-fourth annual report of the Registrar-General must be borne in mind:—

"In these annual reports those deaths only are tabulated as due to diphtheria in which the cause of death is distinctly designated on the certificate as diphtheria or cynanche maligna, or malignant sore-throat. As this rule has been observed throughout the whole series, we may safely use the figures in successive reports for comparative purposes. There can, however, be no doubt that a large proportion of the deaths which were in reality due to diphtheria, are returned under other titles, as ulcerated throat, laryngitis, quinsy, and especially croup. On this account, in previous reports, croup and quinsy were placed among the zymotic diseases, and next to diphtheria. They have now been removed from that position, in deference to the classification of the College of Physicians, and placed elsewhere; but be the true nature of these ailments and their correct nosological position what it may, in any attempted estimate of the actual amount of mortality from diphtheria, the indisputable fact of its being very often returned as croup, or as quinsy, or the like, must be borne in mind."

Whether croup has a title to be considered a distinct disease, or whether the cases coming under that heading should be distributed between catarrhal laryngitis and laryngeal diphtheria, as Dr. Semple contends,* it does not fall within the scope of this paper to inquire.

Comparing with that of diphtheria the curves for scarlet fever and continued fever, it will be noticed that the curve for scarlet fever undergoes violent oscillations of level, especially in the earlier part of the period; a high mortality recurring in periods of four or six years, and being followed by one or two years of very low mortality; doubtless due to the diminution by death, and by the protection afforded to survivors by an attack of the disease, of the number of susceptible individuals in the community.

Since 1870, the mortality from scarlet fever has fallen, especially in the most recent years. This diminution, in spite of the increased facilities for the propagation of the disease afforded by compulsory education, is satisfactory; and

* *Diphtheria.* London, 1879.

seeing that the majority of sanitary authorities have not as yet provided isolation hospitals and disinfection apparatus, it must be ascribed mainly to the increasing regard to what may be called home precautions, brought about by the growth of public opinion and the supervision of sanitary officials.

The death-rate from continued fever, high but fluctuating in the first half of the period, has in the last half steadily declined, no doubt owing to the progress of sanitary improvement.

The curve of diphtheria does not show any close correspondence with that of scarlet fever. It is true that elevations, more or less in amount, accompanied the scarlet fever maxima of 1858-9, 1863-4, 1874, and 1878; but none accompanied the scarlet-fever epidemic of 1870. Nor are there depressions comparable to those of the scarlet-fever curve alternating with the elevations: this may be connected with the slight degree of protection afforded by one attack of diphtheria against another. No diminution in the diphtheria death-rate appears to have been brought about by the sanitary improvements of recent years.

From the mortality statistics published by the Registrar-General, we may learn other facts about diphtheria. We find that the mortality from diphtheria, as from scarlet fever, is highest in the fourth quarter of the year—October to December. Thus, in the fourteen years, 1869-83, the average mortality from these diseases, calculated per 100,000 per annum, has been as follows:—

	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.
Diphtheria	13	10	9	14
Scarlet fever	71	57	64	95

The greater mortality from diphtheria in the fourth quarter of the year seems to be due to the greater prevalence of the disease at that season, and not merely to the greater fatality of the cases that occur. Dr. Airy* has collected records of 140 outbreaks of diphtheria, and tabulated them according to their month of origin. Of the 140, thirty-seven, or more than a fourth, began in October, against only four in January. The number commencing in each quarter was—

1st Qr.	2nd Qr.	3rd Qr.	4th Qr.
16	22	37	65

I have notes of the date of outbreak of diphtheria in 327 households. Of these, 83 were first invaded in the first quarter of the year; 84 in the second; 54 in the third; and 106 in the fourth. The lowest number was 11, in September

* *Transactions of the Epidemiological Society*, New Series, vol. i, p. 64.

(the month when rural schools are commonly closed for the harvest holidays), and the largest, 44, in November, and 46 in December.

Another point in which the behaviour of diphtheria resembles that of scarlet fever is in the relative mortality which it causes at different ages.

In the following table I have shown the average annual mortality from diphtheria and scarlet fever respectively per 100,000 persons living at each age, on the basis of the three years 1880, 1881, 1882.

	Age under 1.	1-2.	2-3.	3-4.	4-5.	5-10.	10-15.	15-25.	25-45.	45 and upwds.
Diphtheria	21	45	54	66	64	33	8.6	2.6	1.4	1
Scarlet fever	107	295	343	347	294	134	25	6	3	0.5

It will be noticed that the mortality from both diseases is comparatively small during the first year of life, but increases rapidly, being more than doubled in the second year. It attains its maximum in the fourth year of life, but continues at nearly the same high level from the second to the fifth year, after which it rapidly declines.

How far does this age-distribution of mortality correspond with the liability to the disease of persons at the different ages? There is reason to believe that children in their first year, and especially infants at the breast, are really less liable to contract infectious diseases than children somewhat older. Also they have not so many opportunities of coming in contact with infection as older children have, *e.g.*, at school, at play, etc. In a young infant, however, the diagnosis of diphtheria is not so easily made as in older persons, and the disease may frequently be recorded under some other name, such as croup. The lessening mortality with advancing age after the fifth year is doubtless due in part to diminished susceptibility to the disease, but also in part to its lessened fatality when occurring in older persons. Among the causes of this diminished danger, the increased capacity of the larynx and trachea, and consequently less risk of death by suffocation, must especially be mentioned.

Unlike scarlet fever, however, diphtheria is more fatal to females than to males. Thus, in the five years, 1878-82, the average annual number of deaths from the two diseases in England and Wales was—

Diphtheria.		Scarlet Fever.	
Males.	Females.	Males.	Females.
1,554	1,747	8,326	8,047

This excess of mortality among females appears to be due to an actually greater susceptibility of the female sex to diphtheria, for in many outbreaks a greater incidence among

females than amongst males has been observed.* In connection with it, however, the smaller size of the air-passages in females than in males must again be mentioned.

It does not exist equally at all ages; during the first two years of life the deaths from diphtheria of males are more numerous than those of females; the excess of mortality among females is greatest between the ages of five and ten.

Another point which comes out strongly from the Registrar-General's tables, and one in which diphtheria contrasts markedly with scarlet fever, is that the former is, in this country at least, a disease specially of rural districts. Thus during the twelve years 1872-83, the annual rates per million inhabitants of deaths from the two diseases were, in the following areas:—

	Diphtheria.	Scarlet Fever.
Liverpool	98	1,047
Great Towns	118	761
England and Wales	126	660
London	144	583
Standard Rural Districts	181	241

Thus the prevalence of the two diseases in these different areas is in inverse order. While scarlet fever was, relatively to population, more than four times as fatal in Liverpool as in the standard healthy rural districts, diphtheria, on the other hand, was nearly twice as fatal in the latter as in Liverpool. Or to put the case differently, in Liverpool there were over ten deaths from scarlet fever to one from diphtheria; in the rural districts, only one and a third from scarlet fever to one from diphtheria.

Nevertheless, large towns are not exempt from epidemics of diphtheria. A severe epidemic of the disease occurred in Portsmouth in 1881, and it annually occasions a very high mortality in Paris, Berlin, St. Petersburg, and New York.

A curious observation is made by Dr. Airy,† tending to show that residence under urban conditions diminishes the susceptibility to diphtheria. A parish school, near the small town of Builth in Wales, was attended in nearly equal proportions by children residing in a portion of that town, and by others residing in lonely cottages and farmhouses on the hill sides. An outbreak of diphtheria occurred at this school, but the twenty children living in the town escaped, whereas, of

* I find among my notes records of 169 cases among males and 209 among females. The greater frequency of kissing, a practice affording facilities for the transference of contagion, among little girls than boys, may perhaps, as was suggested in the discussion on this paper, have something to do with their greater liability to diphtheria.

† *Report to Local Government Board on Several Outbreaks of Diphtheria in the Fourth Quarter of* 1879, pp. 18, 19.

the twenty-five living on the hill-sides eight were attacked. In all respects, except their residence, the children appear to have been exposed to the same conditions.

Having thus discussed the principal facts concerning diphtheria furnished to us by mortality statistics, we have now to consider the causes of the disease.

Of all the modes in which diphtheria may, or may be supposed to, originate, infection derived from a previous case of the disease is that of which the efficacy is the most indubitably established; indeed, I may say that it is the only one which is certainly established. Yet I am not sure that the infectious nature of the disease is always so well recognised, even in the medical profession, as in my humble opinion it ought to be, and this for two reasons, viz., 1st, that the disease often appears to originate *de novo*, no connection with a previous case being traceable; and 2nd, because the degree of susceptibility to the disease varies greatly in different persons and different families, apart from the influence of age and sex previously noted, so that the introduction of a case of diphtheria into a household, even under conditions apparently favourable for its propagation, is not always followed by a spreading of the disease.

It may, therefore, not be altogether superfluous to adduce a few examples noted by myself, showing the infectious nature of the disease.

That when diphtheria attacks a household containing persons of susceptible ages more than one inmate commonly suffers, is a well-known fact, but it does not prove the infectious nature of the disease; for if a number of persons be living under the same conditions, any circumstance, such as an unwholesome state of the premises, will be likely to affect them all more or less, according to their several powers of resistance. The introduction of the disease from a distant place, and its spread from one household to others so situated that communication other than by personal agency is improbable, cannot be thus explained. The following appear to be instances.

In April 1882, a young man, apprenticed to a carpenter in a village in Hampshire, but lodging in a different village, went home for a few days to Portsmouth, where diphtheria was then epidemic. About a week after his return he had a sore throat which kept him from his work for about ten days, and left him weak in the throat, so that he could not swallow without difficulty for some time afterwards. About three weeks after his recovery and return to work, two of his master's children were taken ill of diphtheria, both on the same day, and the

disease went through the family; six out of the seven children suffered, and five died. The father also had a mild attack, with subsequent paralysis of the arms; and only the mother and one boy escaped. The house, which we will call No. 1, was overcrowded, being very small for the then number of inmates, but there was no other noteworthy sanitary defect. The site is open and dry, being somewhat elevated, and on the Bagshot sands. From this house the disease was conveyed to three others, all within a radius of a few yards; there were, however, others equally near which escaped.

In house No. 2 lived an elderly woman, who went in a few times to help nurse the carpenter's children. About a fortnight afterwards, her daughter, aged thirteen, who is said not to have been to the carpenter's herself, was taken ill of diphtheria, and died on June 21st, after three weeks' illness; her mother (who had had diphtheria twenty-five years before) not being affected. After the girl's death the house was thoroughly fumigated, the paper stripped off, and the walls limewashed, and, as it was thought, all infected clothing was washed or fumigated.

It was hoped that the disease was at an end; but five weeks later it broke out in an adjoining household (No. 3), viz., that of the son of the woman whose daughter had died. For a long time this recurrence of the disease was difficult to account for, but it subsequently, by the merest accident, transpired that some of the clothing infected by the girl who died had been put away unwashed, and that her sister, who came home a month later to live at her brother's, had turned it out and washed it; she caught diphtheria and died. In house No. 4, the first case was a boy who had played with the children in No. 3. This outbreak was of great violence; out of the twenty-three inmates of the four houses, fourteen suffered from the disease and ten died; but fortunately it did not spread further, although house No. 4 was the village shop and post-office; this limitation seems to be fairly attributable to the thoroughness of the measures of isolation and disinfection that were carried out. Thus at the post-office, while the disease lasted the shop was kept shut off from the rest of the house, and a professional nurse was engaged to attend to the patients, the post-mistress living and sleeping in the shop.

In the spring of 1883, three children at a farm in Surrey suffered from diphtheria. Another child, a boy whom we will call Albert, had scarlet fever at the same time. Both diseases had previously existed in other neighbouring households, with which these children were likely to have been in communication. Albert was kept apart from the others, in a

separate room approachable only through the outer air, until all were considered to have recovered, and the house had been fumigated with chlorine, when the children were allowed to mix together. Two or three days later, on June 9th, Albert was taken by his father to visit a relative who kept an inn at a village in Bedfordshire. On, or shortly after, his arrival he was found to have a sore throat, and was sent away again on June 12th to another relative, at a village in Northamptonshire, where he died on June 21st, the cause of death being certified as diphtheria. In both the villages Albert's visit was followed by outbreaks of diphtheria. In the Northamptonshire village several children who had been in to see him suffered from diphtheria, but none died. The Bedfordshire village, which stands high on the lower green sand, and is in an unusually good sanitary condition, suffered from a severe and persistent prevalence of diphtheria. The first recognised cases did not indeed occur until six weeks after Albert's visit, but there had been in the meantime a succession of cases of sore throat of a suspicious character, the first being among young men who frequented the inn where Albert was staying.

The attendance of children at school is a common means of propagating the infection of diphtheria as of other diseases, and it was so in this village. On two occasions, several children, all class-mates at the village school (the classes on the two occasions being different ones), but residing in different parts of the parish, were taken ill within a few days of each other, and on each occasion it was found that a few days before a child in the same class had attended school while suffering from incipient diphtheria.

These cases seem to show that the infectious condition of the patient in diphtheria commences early, and may continue after apparent recovery.

The infection of diphtheria attaches itself to houses and rooms with such tenacity as to resist the ordinary processes of disinfection, unless applied with more than ordinary care and thoroughness. I could quote several instances of diphtheria having recurred in households which were supposed to have been thoroughly fumigated with sulphurous acid or chlorine gas.

The disease may also attach itself to, and be conveyed by persons living in an infected atmosphere, but who have not themselves suffered. Instances are given by Dr. Airy and by Dr. Prior, Medical Officer of Health for Bedford.*

It is to be presumed also that the infection may attach

* See also J. H. Salter, *British Medical Journal*, Dec. 1st, 1883.

itself to linen and other articles of clothing soiled by the sick, and may be thus sent from place to place.

The infectious nature of the complaint is also shown by the good effects which have followed prompt and effectual measures of isolation and disinfection.

It is commonly noticed that outbreaks of diphtheria are preceded or accompanied by a prevalence, especially among older persons, of sore throats of a suspicious kind, but not presenting the distinct characters of diphtheria. Sometimes such sore throats are followed by local paralyses, and then there can be little doubt of their diphtheritic nature; but even when not so, it seems probable that these sore throats may be caused by the diphtheritic poison, and may be capable, and indeed a frequent means, of propagating it. They may be looked on, as Dr. Ballard* says, as bearing a relation to fully developed diphtheria similar to that which choleraic diarrhœa does to Asiatic cholera.

A circumstance which I have remarked in some instances is the limitation of an outbreak of diphtheria to a single rural parish, other adjoining parishes, similar in physical circumstances, escaping.† In the absence of common sewerage, water service or milk supply, such a limitation seems to indicate that the disease is propagated by personal infection, rather than by natural physical agents. The boundaries of parishes do not as a rule follow natural features,‡ but the inhabitants of a rural parish have commonly more opportunities for associating with one another than they have with those of even neighbouring parishes.

The following cases enable the incubation period to be determined:—

(1.) A girl living in service came home one Sunday afternoon to visit her friends. Her cousin, a little girl living in an adjoining house, was then ill with an "ulcerated sore throat", which next day was pronounced by the doctor to be diphtheria, and proved fatal. The elder girl visited her cousin and kissed her, and went back on the same day to her place. On the following Thursday (*i.e.*, four days later) she was taken ill with diphtheria, which was followed by pharyngeal paralysis.

* *Medical Times and Gazette*, July 1859.

† See Greenhow, *Diphtheria*, p. 99.

‡ Mr. Topley, of the Geological Survey, has pointed out (*Journal* of the Anthropological Society) that while the position of villages is largely determined by geological conditions, the boundaries of parishes do not follow the outcrops of particular strata, but tend rather to cross them. Thus the villages tend to form a row along the line of strike, and each parish extends over several geological formations, so as to include a portion of each sort of land.

(2.) A married woman went in early one Saturday morning to see a neighbour's child who was dying of diphtheria. This was the only occasion of her entering the house. She was much frightened. On the following Monday afternoon she was herself taken ill with diphtheria, the incubation period being rather over two days (fifty-seven hours).

In several other cases I have noticed the incubation period to be two days.

(3.) A boy of five, residing in an outlying place where no cases had occurred, met one Monday, in a harvest field about a mile distant, an older boy who had had a slight attack of diphtheria three weeks previously, but had just recovered. The older boy gave the little one a ride "on picky-back". On the following Saturday (*i.e.*, five days later) the little boy was taken ill of diphtheria.

Various means of transmission of diphtheritic infection other than by human intercourse have been suggested as possible.

The case of milk will be mentioned later on.

It has been suggested by Mr. Wynter Blyth (*Sanitary Record*, May 1880) and Dr. Airy, that the particulate contagium may be conveyed long distances (*e.g.*, miles) by the agency of the wind. In this way it is thought that the preference of the disease for elevated and exposed situations may be accounted for. It is easy to adduce *à priori* improbabilities against this hypothesis, *e.g.*, the infinitesimally small chance of an infectious particle conveyed by the wind coming in contact with a susceptible mucous membrane, and the apparent little volatility of the diphtheritic poison, which, so far as I have noticed, acts only within a short range, *e.g.*, children in the same class, as in the foregoing instance, being affected, but not those in other classes in the same schoolroom. On the other hand Mr. Power's carefully worked out conclusions as to the dissemination of the small-pox contagium over long distances through the atmosphere must be borne in mind.

Granting the infectious nature of diphtheria, granting also that difficulties in the way of tracking it may arise from the prevalence of slight and unrecognised cases, from the infectiousness of the disease at an early stage and after apparent recovery, and from the persistence with which the contagium may attach itself to places and things, can we thus account for every outbreak, or must we admit that the disease may arise *de novo*, or otherwise than from a previous case?

I think that the common experience is that it is more frequent to meet with outbreaks of diphtheria which cannot

be traced to an antecedent case, than it is of scarlet fever or small-pox, and hence the *de novo* origin of the former disease is more probable than that of either of the latter. Of a number of outbreaks reported to the Collective Investigation Committee of the British Medical Association, in three-fourths there was no known exposure to an antecedent case.

In a place in which scarlet fever and diphtheria were both prevalent at the same time, I noticed that the number of cases in which there was a history of previous infection was greater in the case of scarlet fever than in that of diphtheria; the number of cases of scarlet fever per house was also greater, and the proportion of inmates who escaped was smaller.

If diphtheria may arise otherwise than from a previous case, the next question is, what circumstances may give rise to it?

One of the first and most obvious directions in which to look, is that of other diseases of men or animals; and first of men.

It has long been known that there is a very close resemblance in many respects between scarlet fever and diphtheria; in several respects, as I have before pointed out, their behaviour resembles one another. In former times they appear to have been confounded, and indeed it was not until 1857 that they were separated in the Registrar-General's reports.

The two diseases are often prevalent together in the same locality, and even concur or closely follow each other in the same individual. Usually in this country scarlet fever is entered as the primary disease, and diphtheria as the secondary. Dr. Ballard (*Medical Times and Gazette*, July 23, 1859) gives seven cases in which,—there being satisfactory evidence of diphtheritic exudation, the diphtheria was associated with recent scarlet fever. In only two of these did the rash appear in the course of the throat affection. Of the remainder, in all but one case the rash had left the skin before the diphtheritic exudation appeared.

Of death returns which have come under my notice, in which the two diseases have been conjointly certified, I find that diphtheria has generally been secondary to scarlet fever, and rarely scarlet fever to diphtheria.*

Such cases have usually occurred in the course of an epidemic which has commenced, and for the most part continued, as scarlet fever. On the other hand, Dr. Zum Sande, of

* Heubner (*Jahrbuch für Kinderheilkunde*, 1879, ii, pp. 1-46) gives clinical histories of a number of cases of scarlet fever complicated with diphtheria. Also Greenhow, *Diphtheria*, p. 78.

Lingen, narrates (*Berliner Klinische Wochenschrift*, 1873, x, p. 315) a succession of mixed cases occurring in the course of an epidemic which commenced as, and in most cases presented the symptoms simply of, diphtheria. In the cases referred to, an extensive rash, exactly resembling that of scarlet fever, and followed by desquamation, came out about the eighth day after the commencement of the throat affection. This rash was met with only in young persons; it does not appear to have been followed in any instance by dropsy, and older persons who contracted the disease from such cases suffered from diphtheria only without rash.

It has further been noticed, not only in this country but in Germany and America,* that the two diseases are apparently interchangeable. Dr. W. Squire (*Reynolds' System of Medicine*, 2nd edit., vol. i, p. 129) says, that while the contagion of diphtheria has not been shown to give rise to scarlet fever, that of scarlet fever has apparently been followed by diphtheria. The cases of Zum Sande, previously referred to, if really scarlet fever, seem to show that this disease may be contracted from diphtheria, and I have myself met with cases having the same bearing.

The following are instances which have come under my notice of the association of scarlet fever and diphtheria.

In 1882-3 a severe and protracted epidemic of scarlet fever, accompanied by diphtheria, prevailed at Sutton-in-Ashfield, a small manufacturing town in Nottinghamshire, situated on an elevated limestone plateau. The earliest cases occurred in November 1881, in one of an isolated group of cottages in an elevated situation on the border of the district. These cases, in two children of one family, appear to have been scarlet fever; their origin was not known. When they were recovering, a neighbour came to the house to help with the washing, and shortly afterwards one of her children was taken ill, and two others a week later; of the latter, both died, the cause of death in one case being certified as "scarlatina maligna", in the other as "diphtheria". Throughout the subsequent course of the epidemic the two diseases seem to have existed side by side; some cases having been marked by red rash, and followed by desquamation of the skin and renal dropsy, while others had no rash, but were followed by symptoms of paralysis. In several instances, moreover, the one disease appeared to be contracted from the

* Packard, *American Journal of Obstetrics*, 1879, p. 641. Recent instances of close association of diphtheria with scarlet fever have been reported by the medical officers of health for the Chelmsford Rural, Dartford Rural, St. Thomas's Rural, and Holme Valley combined districts.

be traced in an antecedent case than it is if scarlet fever or small-pox, and hence the *à priori* origin of the former disease is more probable than that of either of the latter. Of a number of instances reported to the Collective Investigation Committee of the British Medical Association in three-fourths there was no known exposure in an antecedent case.

In a place in which scarlet fever and diphtheria were both prevalent at the same time I noticed that the number of cases in which there was a history of previous infection was greater in the case of scarlet fever than in that of diphtheria; the number of cases of scarlet fever per house was also greater, and the proportion of inmates who escaped was smaller.

If diphtheria may arise otherwise than from a previous case, the next question is, what circumstances may give rise to it?

One of the first and most obvious directions in which to look, is that of other diseases of men or animals; and first of men.

It has long been known that there is a very close resemblance in many respects between scarlet fever and diphtheria; in several respects, as I have before pointed out, their behaviour resembles one another. In former times they appear to have been confounded, and indeed it was not until 1857 that they were separated in the Registrar-General's reports.

The two diseases are often prevalent together in the same locality, and even concur or closely follow each other in the same individual. Usually in this country scarlet fever is entered as the primary disease, and diphtheria as the secondary. Dr. Ballard (*Medical Times and Gazette*, July 23, 1859) gives seven cases in which,—there being satisfactory evidence of diphtheritic exudation, the diphtheria was associated with recent scarlet fever. In only two of these did the rash appear in the course of the throat affection. Of the remainder, in all but one case the rash had left the skin before the diphtheritic exudation appeared.

Of death returns which have come under my notice, in which the two diseases have been classified, I find that diphtheria has generally been preceded by scarlet fever, and rarely scarlet fever to diphtheria.

Such cases have usually occurred in the course of an epidemic [illegible] has commonly, for the most part continued, as scarlet fever.

* Reports [illegible]

Lingen, narrates
p. 315) a succession
an epidemic which
the symptoms
an extensive rash
and followed by
after the commencement
was met with
have been
persons who
from diphtheria

It has
Germany and
interchange
2nd edition
diphtheria
that of
theria.
really scarlet
be contracted
cases having the

The following
notice of the
In 1882-3
fever, accompanied
Ashfield, a small
situated on
occurred in
cottages in
These
been called
were
the
Miss
died
Infirmary
[illegible]

apparent connection between
undeniable; the nature of the
ult to explain.
may be propounded:—

id
ad
ph-
er of
from
so that

a typical
er illness,
with what
ntice, aged
ttle girl first
He was taken
ich he died on
he lived, subse-
d by paralysis of
which they resided
n bell trap.
er had tended more to
houses where there were
those noted in the above

other. In some cases the first patient in a family was taken ill with vomiting, sudden accession of fever, red rash, and other symptoms of scarlet fever; but other members of the family, taken ill a few days or a week or two later, suffered from what was pronounced by the medical attendant to be diphtheria, having no red rash, but white patches on the throat, and in one or two instances subsequent paralysis of the muscles of the pharynx. In other instances the children of neighbours who had associated together had, at the same time, some what was called diphtheria, others what was called scarlet fever. One boy, who was taken ill apparently of diphtheria, having white patches on the throat, after three or four days developed the rash of scarlet fever, of which he died.

On the other hand, in one family, of which four members had suffered from well-marked scarlet fever in November, two children had in the following January equally well-marked diphtheria: one of them had had scarlet fever in November, and the other had escaped.

In 1882-3 an epidemic of scarlet fever, associated with diphtheria, prevailed in the Thorne Union, on the borders of Yorkshire and Lincolnshire, a level fenny tract with low islands of new red sandstone and marl, on which the larger villages stand. The neighbourhood suffered severely from diphtheria in 1858-9 (reported on by Dr. Sanderson in the Second Report of the Medical Officer to the Privy Council), and diphtheria, associated with scarlet fever, was also prevalent in 1874 in some closely adjoining and similarly situated places in another Union.

Throughout the epidemic of scarlet fever in 1882-3 the type of the disease appears to have tended towards throat complications: thus, of eighty-two fatal cases, 12 were certified as "scarlatina anginosa", 4 as "scarlatina and diphtheria", 3 as "scarlatina maligna and croup", and 1 "scarlatina anginosa six days, laryngitis one day". Thus, in twenty cases throat symptoms were so prominent as to be specially noted on the certificates of death, while in only seven were renal symptoms so noted. Besides the above, there were five deaths from "croup", associated with scarlatina in other members of the family, and fourteen deaths from diphtheria. These cases occurred in different places, and in the practice of various medical men. There appears to be no room to doubt that the cases recorded as "diphtheria" were, as a rule, correctly so described. A thick false membrane covering the fauces, and on removal often leaving an ulcerated surface beneath, appears to have been a prominent symptom, and

many cases were followed by the partial paralyses characteristic of diphtheria. On the other hand, there were repeated instances in which the two diseases seemed to concur, or even to be interchangeable. What was called diphtheria appeared to have been contracted from a case called scarlet fever; members of the same family suffered together, one from the one disease, others from the other, and in four of the fatal cases the same individual is certified to have suffered from both.

In one family there were five cases of diphtheria, and two of them were accompanied by scarlet fever. The first, a girl of sixteen, suffered from diphtheria in November, but recovered in about five weeks. She had no rash nor desquamation, but remained deaf for some time after her illness. In January, a boy of six, and two or three days later a girl of two and a-half, had diphtheria and scarlet fever together; the girl had subsequent dropsy. Two other children afterwards had diphtheria. There were nuisances in the neighbourhood of the house from pools of sewage and an open middenstead.

In another family there were three cases of diphtheria and one of scarlet fever. The first case (diphtheria) was in a lad of sixteen; the second in a girl of two, who died of "diphtheria"; the third, a girl of twelve, died three weeks later of "scarlet fever"; the fourth, a girl of fourteen, recovered from diphtheria, but her sight a month later was still dim, so that she could not read.

A little girl had, in the latter part of September, a typical attack of scarlet fever. She had, a few days before her illness, associated with another girl, who was then sickening with what proved to be an attack of scarlet fever. The apprentice, aged seventeen, worked in a room into which the little girl first mentioned, after her recovery, used to come. He was taken ill on November 6th with diphtheria, of which he died on November 13th. His mother, with whom he lived, subsequently suffered from diphtheria, followed by paralysis of the legs and pharynx. In the house in which they resided there was a scullery sink with a broken bell trap.

It seemed to me that scarlet fever had tended more to assume a diphtheritic character in houses where there were local unsanitary conditions, such as those noted in the above instances.

The fact that there is often an apparent connection between diphtheria and scarlet fever is undeniable; the nature of the connection is, however, difficult to explain.

The following hypotheses may be propounded:—

(1.) That the connection is apparent only, and due to mistakes in diagnosis;* cases of scarlet fever with exceptionally severe throat symptoms being called diphtheria, and cases of diphtheria, with the rash which occasionally occurs, being called scarlet fever.

That this is not a complete explanation is shown by the occurrence in some instances of the sequelæ respectively characteristic of the two diseases; some cases of scarlet fever, as at Thorne, being followed by renal dropsy, while cases of diphtheria associated with them have been followed by local paralytic symptoms.

(2.) That the two diseases are distinct but concurrent;† the one rendering the individual more susceptible to the other, either by lowering the general vitality and power of resistance, or by denuding the fauces of epithelium, and thus rendering the mucous membrane more suited for the reception of the contagium of the other disease.

It has been noticed that persons who suffer from chronic sore throats are more liable than others to contract diphtheria. Doubtless, an enlarged tonsil or an ulcerated pharynx offers a more favourable soil than a healthy mucous membrane for the development and growth of the diphtheritic contagium, and the sore throat of scarlet fever may do the same.

(3.) That scarlet fever and diphtheria are merely two different forms of one and the same disease, the essence being the same, and the differences being explicable by differences of age and constitution and surroundings of the patients.‡

Against this view is the undoubted fact that an attack of one disease does not protect against an attack of the other,§ as it should do if they were merely modifications, like small-pox and cow-pox, of one thing. Nor, indeed, does one attack of diphtheria offer anything like the same degree of protection against a second attack that is afforded by an attack of scarlet fever or small-pox.‖ Moreover, it is not only scarlet fever which may be complicated with diphtheria; so also may measles, erysipelas, and enteric fever,¶ so that if we are to lump together scarlet fever and diphtheria, we must also join with them enteric fever and various other diseases —a proposition which, though it has been advocated by Dr.

* Semple, *Diphtheria*, p. 19.
† Greenhow, *Diphtheria*, p. 105.
‡ Zum Sande (*loc cit.*).
§ Greenhow, *Diphtheria*, p. 107. One-half of the cases of diphtheria reported by Coll. Invest. Committee had previously had scarlet fever.
‖ Oertel, art. "Diphtheria", in Ziemssen's *Cyclopædia*; Sanderson, Second Report of the Medical Officer to Privy Council; Gull, *ibidem*.
¶ See Dr. Paget, *Brit. Med. Journal*, July 14th, 1883.

Gorrequer Griffiths,* seems to approach a *reductio ad absurdum.*

(4.) On the other hand, it has been contended by Dr. Walker, of Spilsby,† that such cases show that diphtheria is not a distinct and autonomous disease, but that the formation of a false membrane is a pathological process which, like suppuration or dropsy, may occur in the course of various diseases.

Even then, however, we should still have to recognise that there is an infectious throat disease which occurs as an epidemic often uncomplicated with scarlet fever or other similar disease, which runs as definite a course as most other diseases of the class, and which is followed by peculiar and characteristic nervous sequelæ.

On the whole, it would seem that in this aspect diphtheria occupies a position similar to erysipelas and puerperal fever; diseases which, we know, may arise otherwise than by specific infection from a previous case, but which, when once called into existence, propagate themselves among susceptible persons with great energy, and the contagium of which, like that of diphtheria, may attach itself with persistence to places and persons.

The slightness of the protection, if any, afforded by one attack of diphtheria against another is another point in which it resembles erysipelas rather than the more specific infectious diseases, such as scarlet fever and small-pox.

The relation of diphtheria to diseases of the lower animals.—It has been proved by experiment‡ that rabbits can be inoculated with diphtheria. Dr. Sanderson§ has recorded an instance in which swine in a sty adjoining a cottage in which cases of diphtheria were at the time under treatment, and which might have swallowed discharges from these patients, were attacked with the disease, as proved by *post mortem* examination.

At a building used as a temporary hospital during a local epidemic of diphtheria, I was informed by the caretaker that shortly after it was opened for this purpose he had to destroy three cats belonging to the premises which appeared to be suffering from diphtheria; they gasped for breath, vomited, and brought up blood. I have since met with another instance in which the household cat had been noticed to have

* "Unity of Poison", *Glasgow Medical Journal*, July and August 1882; *Brit. Med. Journ.*, February 2nd, 1884.

† *Diphtheria* (Churchill, London).

‡ Oertel, in Ziemssen's *Cyclopædia*, art. "Diphtheria".

§ Second Report of the Medical Officer to the Privy Council, p. 246.

been sluggish and in ill-health ever since the family had suffered from diphtheria.

Dr. Ballard has suggested that diphtheria may be related to disease in mice and other domestic vermin.

Diphtheria has been observed among domestic fowls which had had access to the sweepings of a room in which an affected child was confined.*

It thus appears that domestic animals are liable to diphtheria, and it may be that in some of the instances in which the disease appears to arise spontaneously in isolated places, it may have been contracted from one of the lower animals.

The most important aspect, however, of the question of the relationship between diphtheria and diseases of the lower animals is that of milk supply. A number of instances are on record† in which outbreaks of diphtheria have been shown to follow the distribution of a particular supply of milk. In only one of these, so far as I am aware, viz., that at Little Horton near Bradford, was there any distinct evidence of specific infectious matter having gained access to the milk. In some instances, sanitary defects existed at the dairies of a nature to taint the milk, more especially polluted water supplies and untrapped drains; but in others nothing of the kind could be found. Hence the question has arisen whether any disease of the cow can cause diphtheria in human beings partaking of her milk. In his report on an epidemic of diphtheria at Kilburn in May 1878, Mr. Power suggested as a subject for inquiry whether the form of inflammation of the udder known among dairymen as garget might possess this infective power. The question is still unsettled. In an outbreak of diphtheria at the Princess Mary's Village Homes, Addlestone, Surrey, apparently connected with the milk supply, Mr. Jacob‡ found that one of the cows yielding the milk had been suffering from garget. On the other hand, Mr. Vacher states,§ "There is evidence of gargety milk producing indigestion and diarrhœa, and what may be defined as mild toxic symptoms. This seems to be the extent of the mischief it can accomplish. It has no power to set up any disease allied to garget, such as erysipelas or tonsillitis, so far as I have been able to ascertain."

"Foot-and-mouth disease" is another cattle disease which deserves consideration in this respect,‖ as being prevalent

* *British Medical Journal*, July 14th, 1883.

† Ernest Hart, *Proceedings of the International Medical Congress*, 1881, vol. iv, p. 540.

‡ *Brit. Med. Journ.*, 1879, vol. ii, p. 739.

§ *Sanitary Record*, Feb. 15th, 1882, p. 322.

‖ Second Report of the Medical Officer to the Privy Council, pp. 185-191; Greenhow, p. 199.

among cattle and swine at many of the places attacked during the great diphtheria epidemic of 1858-9. Recently, an extensive outbreak of sore throat at Dover has been attributed by Dr. Robinson to the distribution of milk from a dairy at which the cows were affected with foot-and-mouth disease. The symptoms, however—feverishness, vesicular eruption on the throat, lips, etc., and great enlargement of the glands of the neck—do not appear to have been those of diphtheria.

The following case came under my observation in 1871, when in practice in Somersetshire. The patient, aged thirty, was the wife of a dairy farmer, and the cattle had had foot-and-mouth disease about three weeks previously. The locality was low and rather damp, on the Oxford clay, but the district is one in which diphtheria is rare. The illness began with a swelling of the upper lip, which spread until it involved the whole lip; two days later pustules, something like herpes labialis, appeared along the upper lip. At the end of a week the inflammation had spread until it involved nearly the whole face, extending upwards to the forehead and downwards to the neck. There was dusky redness of the surface, and brawny swelling like erysipelas; the lips were livid and protruded, so as to be in a vertical line with the tip of the nose. There was great prostration. The next day the inflammation had extended into the throat, from which fibrinous masses were detached by coughing. On the twelfth day a mass of diphtheritic exudation, an inch in thickness, was removed from the surface of the upper lip, leaving the mucous membrane beneath apparently sound. She died on the fourteenth day.

The marked tendency of diphtheria to linger and recur in certain localities has naturally caused attention to be devoted to the nature of the soil as a possible factor in the generation of the disease. Low marshy situations on a clayey soil have been thought especially liable to diphtheria, but Dr. Airy considers that it prefers dwellings in exposed and elevated situations on a retentive soil. The Collective Investigation Committee record that, of the places where sporadic outbreaks of diphtheria are reported to them to have occurred, two-thirds are on clay. As regards elevation, one-half occurred in country described as "hilly", one-third as "undulating", and only one-sixth in that described as "flat".

On the other hand, the information collected in 1859 by the Medical Department of the Privy Council showed that the disease had broken out in places situated under diverse physical and geological conditions, and Oertel,* quoting Bartels,

* *Loc. cit.*

states that in Holstein the disease has been observed with almost equal frequency in the swamp districts and on the dry highlands, on moist clay and the driest sand.

Even if it were an ascertained fact that diphtheria occurred most frequently on clay soils, the fact would be without significance, unless we knew what proportion of the rural and urban population respectively dwelt on clay and on pervious soils. I am informed by Mr. Rudler, of the Jermyn Street Museum, that this question cannot yet be answered for England and Wales, as there are considerable portions of the country for which the data have not yet been procured by the Geological Survey.

My own experience, so far as it has gone, has not enabled me to attribute influence to any particular soil or situation. I have had to investigate outbreaks of the disease on clay, sand, limestone, and slate; on high chalk downs and in the fens. Two of the most severe and persistent outbreaks which I have ever met with have been in a manufacturing village on an elevated limestone plateau, and in a residential suburban district on a sandy plain. Dr. Ashby (quoted by Dr. Airy) thinks that diphtheria occurring in places on dry sandy soils, can be traced to infection imported from elsewhere, whereas in places situated on clay it appears to arise *de novo*. This observation should be borne in mind, for further investigation. I may say, however, that while in some instances of diphtheria outbreaks in places on a sandy soil, I have been able to obtain a history of introduction and propagation by infection, in others I have not succeeded in doing so.

An important practical question is, can diphtheria be caused or propagated by unsanitary conditions? If we are content to take our answer from mortality statistics, it must be "no". We have seen that the death-rate from diphtheria in the healthiest rural districts is double that in the most unhealthy towns. We find also, that whereas since the passing of the Public Health Act, 1872, the total death-rate, the infant mortality, the death-rate from zymotic diseases, and notably that from "fever", have declined, that from diphtheria has remained nearly stationary, and has even latterly shown a tendency to increase. Moreover, it is notorious that diphtheria frequently breaks out in houses in which no sanitary defect can be found. Sir William Jenner says,* "The infection-element does not require for its development any of the ordinarily considered anti-hygienic conditions. It is very doubtful even if any of those anti-

* *Diphtheria: its Symptoms and Treatment*, 1861.

hygienic conditions favour its development, or give to it a more untoward course when it occurs."

On the other hand, it is frequent in sanitary reports to find that such and such unwholesome conditions were met with at a house where diphtheria broke out, and that these were looked upon as the cause of the disease. In this matter there is especial danger of *post hoc* being mistaken for *propter hoc*. Diphtheria breaks out in a household, perhaps with appalling fatality: the health officer appears upon the scene, naturally and properly anxious to discover the cause, not only for his own credit's sake, but also in order to prevent the recurrence of a similar calamity in the future, and, under these circumstances, the foul pigsty, the objectionable cesspool, or the trapless drain gets blame which is perhaps not its due.

Nevertheless, I must own to an impression—I can scarcely call it a belief—that diphtheria may, under certain unknown conditions, be caused by the inhalation of foul effluvia from drains and decomposing organic* filth. I have met with many instances of diphtheria breaking out in houses which were liable to the entrance of drain air.

I have recently heard of an instance in which a youth, the son of a medical man, was taken ill with diphtheria a few days after having dug up and attempted to clean, for the purpose of making an anatomical preparation, the putrid skull of a large dog; and of another in which diphtheria, previously unknown in the district, broke out among the children of a household, of which one of the inmates was an elderly woman with a then very offensive chronic ulcer of the leg; from this household the disease spread to two or three others. We know that a form of sore throat is often produced by the breathing of foul air, such as that contaminated by drain effluvia, or the unwholesome air of an ill-kept hospital ward; and it may be that such sore throats may pass on into diphtheria, or, at any rate, may render the subject more liable to contract the disease if its exciting cause should happen to be present.

From what we know of the geographical distribution of diphtheria, its rarity in large towns, which are usually furnished with good water from extraneous sources, and its preference, according to some observers, for clayey tracts where good water is difficult to get, we might expect that, of all unsanitary conditions, polluted water would be found most likely to be associated with diphtheria production. I cannot say,

* *Conf.* Dr. A. Carpenter and Dr. E. F. Willoughby, *Brit. Med. Journ.*, March 1st, 1884.

however, that I have met with, or found recorded, any instance in which this disease appeared to pick out the consumers of a particular water-supply in the way that enteric fever is wont to do.

In overcrowded and ill-ventilated houses diphtheria appears, as one might expect, to spread with greater facility, and to exhibit a severe type.

Dampness of houses, arising from wetness of site, defective construction of walls, or disrepair of roof or eavespouts, is a condition which has been noticed in many instances. It deserves mention in connection with the supposed fungoid origin of diphtheria.

It has been noted by different observers* that the conditions under which diphtheria most often occurs are those which are favourable to the growth of cryptogamic vegetation. Thus it avoids densely populated towns and smoky manufacturing districts,† and develops in moist situations, and at the time of the year when the air is most humid, decaying vegetable matter most abundant, and fungous life most plentiful.

From time to time attempts have been made to connect diphtheria with one or other low vegetable organism.

Dr. Michael Taylor, of Penrith,‡ records an isolated outbreak of diphtheria, associated with the growth of fungi on a wall of the bedroom in which the patient had slept. The wall had become saturated with wet owing to the stoppage of the eavespouting, and from the wet plaster two kinds of fungus sprung—a toadstool (*Coprinus domesticus*), and a mould (*Aspergillus* or *Fibrillaria*).

Dr. Laycock§ formerly supposed that the cause of diphtheria was to be found in a mould (*Oidium albicans*), the mycelium and spores of which are to be met with in pene-

* Airy (*loc. cit*).

† "Lichens will not grow in a flourishing or perfect condition in the immediate neighbourhood of towns or where the air is impregnated with smoke, soot, or other deleterious ingredients. In such situations, they exist only in a gonidial or rudimentary state, appearing on the walls, trees, etc., as green dust, in which state they will continue for ages, increasing by bisection like the algæ, but never developing into perfect lichens. Their abundance in a fully developed and fructiferous condition is a sure and certain indication of the purity of the air and salubrity of the climate."—Rev. W. A. Leighton, *Lichen Flora of Great Britain*, p. 1. *Query*. Can the comparative exemption of English towns from diphtheria, as compared with its fatality in foreign cities, be due to the difference in the fuel habitually burnt? The products of combustion of coal are far more inimical to cryptogamic vegetation than those of wood or peat.

‡ *Brit. Med. Journ.*, July 2nd, 1881.

§ *Med. Times and Gaz.*, May 29th, 1858; Wilks, *ibid.*, October 1858.

trating the false membrane. The same idea has more recently been supported by the Rev. J. E. Vize, an able mycologist.*

The occurrence of the öidium in the diphtheritic exudation is not questioned; but whether it be the cause of diphtheria, or whether it merely finds, in the exfoliating epithelial tissues, a suitable soil in which to develop, is open to doubt. Oertel† has observed the öidium, with other similar fungi, to be present in the layer of slime covering the tonsils in cases of catarrhal inflammation, and to disappear when diphtheria sets in, being replaced by micrococci, reappearing in the old thickened patches which remain as the case advances to recovery. Oertel and other German pathologists recognise as characteristic of diphtheria minute spherical bacteria or micrococci, which multiply and penetrate the tissues; and they find by experiments on animals that the inoculation of these micrococci produces the disease, the morbid process starting from the point of inoculation.

In France, Talamon‡ has also announced the discovery in diphtheria of a low vegetable organism consisting of fine threads, breaking up into spores of two kinds, the one round or oval, the other rectangular, and says that he succeeded in producing the disease by inoculating rabbits, frogs, etc., with the cultivated organism.

Here, however, we find ourselves in a wide field, and one of which I have no claim to speak from personal knowledge. I will, therefore, detain you no further than to say that it seems probable, from what we know of the behaviour of diphtheria, that its cause will ultimately be found to be some low organism, which, while capable of passing its existence outside the human body, and perhaps habitually doing so, can nevertheless, under certain circumstances, acquire and transmit to its progeny a parasitic habit and toxic properties.

* *Transactions of Powysland Club*, Part XXIV, April 1879.
† Art. "Diphtheria", in Ziemssen's *Cyclopædia*.
‡ "Note sur le microbe de diphthérie", *Progrès Médical*, February 12th, 1881.

ON THE REVACCINATION OF SCHOOL CHILDREN.

By R. D. R. SWEETING,
Medical Superintendent Western Fever and Small-pox Hospital, Fulham.

(*Read: July 9th*, 1884.)

A PHASE of the vaccination question which is sometimes lost sight of, and the importance of which is often undervalued by advocates of the system, is the consideration of the number of vaccinated children who are attacked with small-pox, and how this may be explained or obviated.

Not so, however, the opponents of vaccination, who, in their endeavour to harmonise results with preconceived *animus*, neglect to place upon them the correct interpretation to be derived from careful examination.

I have collated from the Minutes of the Metropolitan Asylums Board the following statistics relating to vaccinated children under puberty (taking this at 15) admitted into the different small-pox hospitals of the Board during the years 1879, 1880, and 1881, distinguishing those well and those imperfectly vaccinated.

The following Table (A) shows this :—

TABLE A.

Hospital.	1879.		1880.		1881.		Grand Totals.	
	Good.	Imperfect.	Good.	Imperfect.	Good.	Imperfect.	Good.	Imperfect.
Fulham	1	74	2	32	10	320	13	426
Deptford	*128	*201	44	95	261	418	433	714
Stockwell.....	12	26	47	33	49	121	108	180
Homerton	5	14	38	137	33	108	76	259
Totals	146	315	131	297	353	967	630	1579

The maximum number of admissions thus occurred in 1881, this being an epidemic year. Deptford Hospital furnishes more than any other, and a greater proportion of well-vaccinated cases; whilst the ratio of these to the total is least in the case of Fulham Hospital.

* Part of 1878 is included in and inseparable from these numbers.

It will be seen from this table that 72 per cent. of the admissions under fifteen were imperfectly vaccinated.

Again, Dr. Collie* shows that of the 313 vaccinated admissions under fifteen years of age under his care in the Homerton Hospitals in 1881, only 71 (equal to 22 per cent.) presented from four to six good marks.

(It might be noted here that the standard of "good" vaccination allowed in the Asylums Board Hospitals is more lenient than that demanded by the Local Government Board, the former allowing one-third of a square inch, and the latter requiring at least half a square inch of well-foveated surface for first-grade vaccination; so that, if the Government standard were adopted in the small-pox hospitals, a still smaller number of well-vaccinated admissions would probably be recorded.)

Approaching the question that we have set ourselves to consider, we find, therefore, that the vast majority of such children are imperfectly vaccinated, and are further justified in inferring that the number would be still greater, were a less lenient standard of perfect vaccination in force.

Let us now examine the age-distribution of these cases, dividing them into three groups, corresponding to the three first quinquenniads of life. This is shown in the following Table (B):—

TABLE B.

Hospital.	Age, 0-5.		Age, 5-10.		Age, 10-15.		Grand Totals.	
	Good.	Imperfect.	Good.	Imperfect.	Good.	Imperfect.	Good.	Imperfect.
Fulham	2	35	2	125	9	266	13	426
Deptford	25	34	136	221	272	459	433	714
Stockwell	14	20	32	49	62	111	108	180
Homerton	9	27	24	102	43	130	76	259
Totals	50	116	194	497	386	966	630	1579

From this Table it will be perceived that both the gross numbers in each age-group and the specific sub-divisions increase with the age, and in the same progression. And this will be found to be in both cases approximately as $1 : 4 : 8$, or as $1 : 2^2 : 2^3$. It may be incidentally remarked that this ratio exhibits the comparatively greater protection afforded to children under five than to those over that age.

Now comes the query, how is the number of admissions of vaccinated children to be diminished? In other words, what

* Annual Report for 1881.

means must be adopted to lessen or minimise their chance of getting small-pox.

From a further examination of Table B, attention will be drawn to the fact that it is not only the numbers of the imperfectly vaccinated that increase in a mathematical ratio with the age, but also that the numbers of the well-vaccinated admissions increase in the same ratio.

Hence, after making due allowances for the "personal equation" which comes into play in the observation and recording of vaccination marks, but which usually corrects itself in a large and varied aggregation of figures, the conclusion seems warranted that a renewal of the operation is indicated, chiefly for the imperfectly vaccinated in infancy, but also for those cases where a good vaccination has shown signs of wearing off with increasing age.

Dr. MacCombie,* from a comparison of the percentages of vaccinated admissions at different ages to the total, comes to the following conclusion. "Speaking from an experience of nearly 4,000 vaccinated patients treated in this hospital, I should say that it is impossible to lay down an absolute rule as to the precise age at which a second vaccination should be performed, but I should certainly recommend its performance five years before puberty (15), rather than wait till puberty; and were children exposed to small-pox infection at any age from five to ten, they should certainly have their vaccination tested, even if the primary vaccination might have been good" (*op. cit.*, p. 11).

When we consider the large amount of imperfect and inefficient vaccination that is continually passing current, as evidenced by the results of the careful examination of the marks in cases admitted to small-pox hospitals, we must look around for some provisional method of meeting a pressing difficulty, until the time arrives when vaccination will be solely in the hands of public vaccinators acting directly under a sanitary authority. This method, to my mind, will be best found to consist in the inspection and revaccination of school children, which has the double advantage of convenience and readiness of applicability.

The committee of the Homerton Hospitals, in their Annual Report for 1876,† referring to the large number of vaccinated admissions during that year, and to the fact that they were mostly between the ages of ten and twenty-five, draw attention to the need for revaccination, and advocate its compulsory performance in the case of school children. "This could

* Report of the Medical Superintendent of Deptford Hospital for 1881.

† *Metropolitan Asylums Board Minutes*, vol. xi, pp. 179-84.

easily be effected, as all children are compelled by law to attend school, and arrangements could be made for periodical revaccination by the public vaccinator of the district. Little opposition to such an arrangement would probably be offered, it being fair to presume that the parent who does not object to vaccination, under compulsion, of his child when an infant, would not oppose its revaccination at a later age. By such means, not only would the protection against small-pox afforded to the child by the primary vaccination be extended, probably to the remainder of its life, but those children who have escaped being vaccinated, or who have been inefficiently vaccinated (and there appears to be a large number of these), would also be protected. Such a course of action, if vigorously and efficiently carried out, must, the Committee believe, have the effect of diminishing considerably the number of victims to small-pox epidemics" (*op. cit.*).

By the kindness of Dr. Reilly, Assistant-Secretary to the Illinois State Board of Health, I was favoured last autumn with the proof sheet of an Order of the Board dated September 20th, 1882, relating to school vaccination, and addressed to "County Superintendents, School Boards, and Teachers." After demonstrating the "wisdom and utility" of the preceding one, promulgated in December 1881, the Board issues additional instructions as follows:—"At the beginning of the school year, teachers must satisfy themselves of the vaccinal status of each of their scholars. This will be done in the case of scholars who were in attendance during the last term by an examination of the vaccinal record required to be kept by the teachers, or by an examination of the scholars' certificates. Scholars whose records are imperfect, as well as all new pupils, must present to the teacher, (*a*) certificates of proper vaccinal protection; or, (*b*) certificates that they are protected by previous attacks of small-pox or varioloid; or, (*c*) that they are insusceptible to vaccination; or, (*d*) that their physical condition is such as to make it imprudent to vaccinate at the present time. Proper vaccinal protection means a successful vaccination in a child not yet arrived at the age of puberty, or, if beyond that age, a successful vaccior revaccination, as the case may be, performed within the past two years (approximately). The certificates above described must be signed in all cases by legally qualified physicans. . . . . It is recommended that each teacher be provided with a book—Vaccination Record—in which to keep a permanent record of the vaccinal history of the scholars."

This extract shows with what facility a complete system of

vaccinal registration could be instituted in the Board schools of London. Such a method of record, if supplemented by periodical inspection of scholars' arms by competent persons, and logically extended into powers to compulsorily revaccinate those children who presented inadequate or imperfect scars (omitting for our present purpose consideration of the unvaccinated), would seem to afford a powerful means of coping with the evil.

I do not pretend to indicate the details of such a system, being content to lay before the members of this Society, which has so pre-eminently distinguished itself in its advocacy of the benefits of vaccination, and possesses the honour of having suggested its compulsory adoption to the Legislature, the bare outlines of a scheme intended to reduce to as practicable a zero as possible the chances of children being attacked with small-pox.

As to the Central Authority to be concerned in its administration, this would seem to rest between the Education Department, the Local Government Board, and the projected new Municipality. If, however, the supervision of vaccination in London were placed in the hands of the Hospital Authority recommended by the Hospital Commissioners,* a transference which was advised by Dr. Stevens in his evidence before them,† steps might be taken to include amongst the duties of such Authority the care of the vaccinal registration, periodic inspection, and compulsory revaccination of school children.

* *Report.* Blue Book, 1882.
† *Minutes of Evidence,* pp. 194-202. Blue Book, 1882.

NOTES ON THE DEATH-RATE FROM SMALL-POX IN THE CITY OF CHESTER IN 1774.

By CHARLES E. PAGET,
Medical Officer of Health for Westmorland and Sedburgh Rural District.

(*Read: July 9th*, 1884.)

THE opportunity has been afforded me to bring to the notice of the members of our Society an interesting report upon the sanitary condition of the city of Chester, and upon the prevalence of sickness within it, 110 years since. The report, there is no doubt, was written by Dr. J. Haygarth, a physician of repute, who was at that time at Chester, and afterwards practised at Bath. The copy of it now before the Society belongs, with other documentary relics, to the office of the Regius Professor of Physic in the University of Cambridge; and, owing to the interest which some epidemiologists may find in perusing it, I have obtained leave for its reprint before returning it.

The reason why the report is brought to the notice of our Society to-night is to be found in the records it contains of the behaviour of small-pox in Chester during an epidemic prevalence of the disease—though apparently not an exceptionally virulent one—occurring in the year 1774. From the Tables contained in the report the population of Chester appears to have numbered 14,713, and the average annual mortality from small-pox to be estimated at 49, or at the rate of 3.3 per 1,000 of population. In 1774 the total of deaths was 546, of which 202 were from small-pox, or at the rate of 13.7 per 1,000 of population. The total number of persons attacked by small-pox was 1,385, so that, as stated in the report, one died out of $6\frac{6}{7}$ of those attacked, or at the rate of 14.5 per cent. The incidence of the disease appears to have been exceptionally large in the last three months of the year—130 deaths out of the 202 being recorded during that period. It seems amazing that, within such recent times, the death-rate from small-pox should have been so enormous; for, taking the average annual mortality from small-pox in Chester as 49, it will be seen by Table VI of the report that one-eighth part of the whole annual mortality

was from small-pox. The report further states that in January 1775 there were in Chester only 1,060 persons, or 1 out of every 14, who had not contracted small-pox—a proportion quite as remarkable as that of the average mortality from the disease—and yet it commences with the statement that the "Tables prove Chester to be healthy in such an uncommon degree as will astonish those who are best acquainted with the general state of mortality in large towns".

It is interesting to note the views of a painstaking physician of those times as to the possibility of controlling by inoculation the ravages of small-pox, for Jenner's attention appears to have been directed towards cow-pox only in 1775, and his first decisive experiment in vaccination to have been performed just twenty-one years later. Dr. Haygarth believed that if inoculation were universally practised in Chester, that the mortality from small-pox would be reduced from 49 to 4; but probably this estimate was much too low, and it is fortunate that the practice of inoculation was not pursued so vigorously as to delay the introduction of vaccination. He estimated, however, from his elaborate tables, that the proper time for the performance of inoculation was between the first and third months of infancy, a time fully agreeing with that which has been shown as best for the performance of primary vaccination; and he pointed out that the total 202 deaths from small-pox already referred to were among children under ten years of age. The comparison, therefore, of the mortality from small-pox at that date with that which has been recorded of late years, will not be found wanting in interest; for the infant mortality from small-pox has now been reduced enormously, and the mortality among adults appears to arise chiefly through their not being revaccinated.

Such infant mortality as is thus represented could not but keep the increase of the total population somewhat in check; but supposing that the population of Chester were as it is now, that the protective influences of vaccination were not in force, and that the figures contained in this report be correct, the city of Chester would present some such vital statistics as these:—

Population of municipal borough in the census of 1881 ...	36,788
Estimated population in 1884	37,250
Average annual mortality from small-pox	122
Mortality during small-pox epidemic ... ... (about)	510
Probable amount of small-pox sickness during epidemic (over)	3,500

Other matters of interest will be found in the report, which deals with the conditions of the soil, situation, and surroundings of the city, and on the prevalence of phthisis

within it; refers to the advantages which might be expected to arise from the erection of an infectious diseases hospital for the isolation and treatment of cases arising among the poorer classes; and describes an outbreak of disease following certain meteorological disturbances.

As a self-constituted medical officer of health, Dr. Haygarth probably rendered good service over 100 years ago to the city of Chester; but his forecast of the good to be derived from the division of towns and districts, for purposes of general inspection, is of interest now, as an indication that thoughtful men at that date looked forward to a harvest of great gains in the development of a study of the public-health.

(Reprint.)

Observations on the Population and Diseases of Chester in 1774.

The facts ascertained in the following Tables prove Chester to be healthy in such an uncommon degree as will astonish those who are best acquainted with the general state of mortality in large towns. In order to deduce satisfactory and useful conclusions from these facts, it seems necessary to describe a few peculiarities in the situation of this city, which probably contribute to produce a salutary effect. The intelligent reader will remark, in the following account, that the structure of Chester prevents, in an uncommon degree, two principal sources of disease, *stagnant moisture* and *putrefaction*.

Chester is placed on a red, sandy, mouldering rock (*Saxum arenarium friabile rubrum*), which forms a rising promontory whose summit is elevated exactly one hundred feet above high-water mark; from this point the streets descend with a gentle declivity every way to the edge of the rock, where there is a perpendicular fall of many feet nearly from every part of the town.

The loose rock on which the town is built quickly absorbs moisture, for being cut into filtering stones, water soon passes through its pores. The principal streets that meet in the centre of the city are deeply excavated out of the rock, being sunk six or nine feet lower than the surface of the ground. By this structure the foundation of the houses is kept perfectly dry, as the streets form an excellent drain to that moisture which the rock has not absorbed.

There is a form of building peculiar to Chester, called the *Rows*, which are covered galleries to walk through, that make

a complete communication between most of the principal streets. The Rows are always dry and clean, even in wet and dirty weather; they moderate the heat of summer and the coldness of winter. These uncommon advantages oftener tempt abroad persons of a delicate and valetudinary constitution, whether they are engaged in business or amusement, by which they obtain the benefit of fresh air and exercise, without incurring danger from catching cold.

The *Walls* are near two miles in circumference, and surround the central part of the city: they are dry and clean immediately after the heaviest rains. The Rows form a dry communication with the walls from nearly every place within their circuit; their frequent ascents and descents; their elevated airy situation, and varied prospects, all contribute to render walking upon them peculiarly well-adapted to preserve or to restore health.

The Dee, a large navigable river, divides a small part of the town from the rest, skirts the smaller, and surrounds three quarters of the larger portion. Where it makes this division, it falls over a causeway, forming a widely extended cascade, and then runs with rapidity down loose rocks; the whole descent is 13 feet. The tide always flows up to the town, where it rises on a medium of spring tides 15 feet, the highest tides 21 feet: every new and full moon about 6 or 8 tides flow over the causeway, and sometimes more than 20 miles above the town. Besides washing away the liquid filth, which quickly runs into the river by a short course from nearly all quarters of the town, the agitation of waters both by the cascade and tides is probably of farther service in purifying the atmosphere.

The air of Chester is uncommonly clear. In a register of the weather, kept for the last four years, there were only 6 foggy and 32 hazy mornings. In general, the atmosphere on the western is much clearer than on the eastern shore of Britain; though more rain falls on the west than on the east side of the island.

The modern refinement of manners, under the opprobrious name of luxury, is generally thought to be peculiarly destructive to health; but the true friend of mankind will candidly, and without prejudice, inquire into the facts which only can determine his judgment on this important subject. A large portion of the inhabitants of Chester enjoy, with *temperance*, the elegant refinements of life, yet no disorder except the Gout, can be peculiarly ascribed to this cause, in the Tables of Diseases for the last three years, that is, no more than 2 deaths out of 1277. But it is to be observed, that refined manners here, as they generally do everywhere

entirely banish the destructive excesses of gluttony and drunkenness. It is the large quantity, rather than the rich quality, or exquisite flavour of what we eat and drink, that is injurious to health.

As the healthiness of Chester must appear so very extraordinary as to be almost incredible, it is necessary to declare that the enumeration was made with all possible care and fidelity; and that the errors are, for obvious reasons, rather on the side of defect than excess, so as to make the proportional mortality rather appear greater, not less than the truth. Two facts may be mentioned in proof of this position. In 1772 the inhabitants of St. Michael's parish were reckoned to be 618, and there cannot be the smallest suspicion that there are fewer than this number, and yet by the survey, Table V, they are only 575. Again, the deaths, by fever, appear to be 35 from the parish registers, and only 28 from the survey. I know no error on the side of excess, except in Trinity parish, where a new street has been inhabited only 6 years. This circumstance will clearly occasion this district to appear in Table VII more healthy than the truth.

In estimating the health of the district which belongs to the Cathedral, because it appeared so very extraordinary, particular care was taken to ascertain the exact truth. As some of these houses have not been built the whole period included in this calculation, more than a proportionable allowance of deaths is made for this deficiency.

In order to exhibit a just, and most striking view of the health of Chester, especially the centre, beyond other places both of town and country, the reader is particularly requested to compare the VIIth with the VIIIth Table. The VIIth Table is composed by finding the proportion of inhabitants in the different parishes separately and together in the Vth, to the burials for ten years recorded in the VIth Table. In the VIIIth Table the mortality of whites in Jamaica is taken from Dr. Lind;—of Liverpool and Manchester from Drs. Enfield and Percival, who directed particular surveys of those towns;—of the other places both of town and country, from Dr. Price: so that no facts can be ascertained on more respectable authorities. That the inhabitants of Chester should have near an equal chance of living to *twice* the age of the inhabitants of Vienna, London, or Edinburgh, and that no large town, as far as inquiries have been hitherto made, should approach to a nearer proportion of longevity than as 28 to 40, are astonishing facts. The centre is by far the most salubrious part of the city; the average of deaths within the walls is only 1 in 58, a degree of

longevity much superior to what in general is recorded even of the country. The parishes which include the suburbs, viz., St. Oswald's, John's, Mary's and Trinity are of the largest size, and comprehend many central parts of the town which are undoubtedly as healthy as any of the rest, but they also contain all the outskirts which consequently must be much more unhealthy than appears to be the general average of deaths in those parishes.

There is one probable cause that renders the suburbs more unhealthy than the rest of the town. A part of the putrid filth which flows from the centre to the circumference stagnates in the ditches of the suburbs, viz., the Headlands, Barker's Lane, Horn-lane, and Greg's Pit in John's parish; Fluckersbrook and Cow-lane in Oswald's parish; Nun's-lane and garden, Skinner's-lane and Stye-lane in Mary's parish; the Sluices, and the Rood Eye in Trinity parish. There is not one instance of stagnant water within the city walls except in Nun's-lane, and garden. As there is a sufficient declivity from all these ditches into the river, it would be a very easy, and most salutary improvement to drain them perfectly, and seems highly to deserve the attention of our magistrates.

The antients were particularly attentive to such salutary regulations, as appears from a letter of the younger Pliny to Trajan. *Amastrianorum civitas, domine, et elegans et ornata, habet inter præcipua opera pulcherrimam, eandemque longissimam plateam: cujus a latere per spatium omne porrigitur nomine quidem flumen, re vero cloaca fœdissima: quæ sicut turpis, et immundissima aspectu, ita pestilens est, odore teterrimo. Quibus ex causis, non minus salubritatis quam decoris interest eam contegi.* By the induction of numerous facts, two principal sources of continued fevers have been discovered, that is, the contagion of human *effluvia*, and of marsh *miasmata:* the latter is distinguished by frequently assuming an intermitting type, or changing into a dysentery. It may be doubted to which kind of pestilence the putrid ditches of towns belong. From this filth being chiefly of animal origin, and from the absence of both intermittents, and dysenteries, even in their neighbourhood at Chester, I should conclude that they produce the same kind of fevers as human contagion: and yet I doubt whether the agues, and dysenteries of Edinburgh can probably be attributed to any other cause. Unless the frequent fogs of this place, or *miasmata* from the north loch and from the moist foundation of the houses in the Cowgate, etc., where there was formerly a loch, may be supposed to produce such an effect.

Another reason of greater mortality in the suburbs, seems

to be, that their inhabitants in general are of the lowest rank: they want most of the conveniences and comforts of life: their houses are small, close, crowded, and dirty: their diet affords very poor nourishment: and their cloaths are seldom changed or washed. These parts of the town are supplied less plentifully than the rest with water from the river. The air they breathe at home is thus rendered noxious by respiration and putrefaction. These miserable wretches, even when they go abroad, carry a poisonous atmosphere around their bodies that is distinguished by a noisome and offensive smell, which is peculiarly disgustful even to the healthy and vigorous, exciting sickness and a sense of general debility. It cannot therefore be wonderful that diseases should be produced where such poison is inspired with every breath. This noxious air is the most frequent cause of malignant fevers. In these poor habitations, when one person is seized with a fever, others of the family are generally affected with the same fever in a greater or less degree. This dreadful consequence is naturally to be expected: as putrid steams arising from the diseased body are added to the other increasing causes that produce noxious air.

If a regulation could be universally adopted of immediately removing out of the family such of the poor people as are seized with fevers, it is evident that the most salutary consequences would follow. Reasonable objections might be made to receiving such patients into the general Infirmary, even into separate wards, lest the infection should spread through the whole house, which in a former paper on this subject was proved to be healthy to an uncommon degree when compared with other Hospitals. But might not this and every other objection be obviated by erecting on the ground which adjoins and belongs to the Infirmary a small building to be divided into spacious, airy, separate apartments, where patients infected with fevers, and properly recommended might be received on any day of the week? Besides medical assistance, they would here enjoy clean linen, airy rooms, careful attendance, and wholesome diet.

Towards the latter end of August there appeared a fever which from its frequency might be called epidemical. It was preceded by sultry weather, and commenced immediately after a strong gale of wind from the west on the 17th, succeeded by 8 fair days. It has been remarked by Dr. Stedman that storms prevent epidemics. I would not allege this as an instance to refute the ingenious observation. But the want of rain during and eight days after the high winds, was perhaps the cause why they produced a pernicious

rather than a salutary effect. The admirable discovery of Dr. Priestley, that water corrects and purifies air rendered noxious by respiration and putrefaction, makes this conjecture extremely probable.

From the vth Table it appears that this fever attacked 285, and was fatal to 28, that is, to 1 in 10. It had the common symptoms of malignant fevers produced by human effluvia, and particularly affected the head with pain, giddiness, and delirium. This fever attacked in general the lowest, few of the middle, and none (or only one) of the highest rank. Among the poor, when one was seized the rest of the family suffered more or less with like symptoms. But in no instance appeared any marks of infection, even in the nurses, where the patients enjoyed the comforts of clean linen, and airy rooms.

Antimonials of various kinds were given at different periods of the fever. They rendered the pulse less frequent in some instances, if reckoned immediately after the operation, but in very few cases produced any lasting abatement of symptoms. After a full effect of the antimonials, the peruvian bark was given in a considerable quantity, but it neither abated nor aggravated the fever. The remedy of most manifest service in this epidemic was topical evacuations from the head by leeches and blisters.

From the IInd Table it appears that there were 4 fatal instances of the puerperal fever in 1774: a disease which frequently occurred this year, though I had never before seen it in Chester, during seven years' practice.

In making the general survey of the town particular inquiries were made concerning the proportional fatality of the natural small-pox, in order to demonstrate the advantages of inoculation, and to discover at what age this operation should be performed, that it may become the most extensively beneficial to society. The proportion of deaths by the natural small-pox to all the deaths this year is 1 to 2 and 7-10ths. Of all the persons attacked by the small-pox, 1 in 6 and 6-7ths died, as appears from the vth Table. From the same Table it is evident that 1060 have never had the small-pox, out of 14713 inhabitants, that is, 1 in 14. If the former numbers express the usual fatality of this disease, and the latter ascertain the proportion that never have it, we may conclude, where inoculation is not practised, that one *eighth part of mankind* die of the natural small-pox.

I do not know that the proportion of deaths by inoculation has been accurately ascertained since the late improvements

in this art. But if we suppose that 1 in 100 dies by inoculation (a proportion perhaps four or five times more than the truth) then out of every 200 born 25 would die of the natural small-pox and only 2 by inoculation, that is 23 lives might be saved in every 200, or 1 in 8 and 2-5ths nearly. The annual births in Chester being 397, the annual deaths by the small-pox would be 49, and by inoculation only 4. If therefore inoculation were universally practised in this place, 45 lives of our fellow-citizens would be saved every year from the ravages of this fatal disease. If the humane and intelligent are desirous of assisting their indigent and ignorant neighbours in establishing a plan for general inoculation, a scheme shall be submitted to their consideration which appears to be easily practicable. Few occasions occur in society so highly grateful to the benevolent mind, as the power of saving more than 1 life out of every 9 of our fellow-creatures.

The facts recorded in Table IV seem to determine the age when children should be inoculated in order to secure the greatest possible benefit to mankind. It appears here that under 1 month old not one died of the small-pox, that under 3 months old only 3, that under 6 months 7 out of 202; and yet above a quarter of the whole died under one year old. From these facts it follows, that inoculation ought to be performed between 1 and 3 months old, especially in large towns, and when the disease is epidemical. Similar observations made at Manchester concerning the fatality of the small-pox in early infancy, have induced my friend Dr. Percival, with much candour and good sense, to draw a like conclusion, and to correct a former opinion on this subject founded on the greater safety of inoculation in children a few years old. Indeed, where children can be secured from all danger of the natural infection, the greater hazard to young infants from inoculation will be a sufficient reason to defer the operation for 3 or 4 years. The small-pox was fatal to 22 males and 29 females under one year old, that is, to seven more females. This fact confirms what Dr. Percival observed at Manchester. The epidemic small-pox begun near the summer, and almost ended at the winter solstice; only 19 remaining ill of the disease in January 1775, when the general survey was taken.

Dr. Price, in his excellent observations on annuities, &c., has adduced numerous facts to prove that women live longer than men. These Tables afford many confirmations of the remark. There died this year under 20 years old 162 males and 149 females, that is, a majority of 13 males; 52 husbands and 50 wives, that is, 2 more husbands; 28

widowers and 48 widows, which is only a majority of 20 widows, though by the general survey, Table v, there are in Chester 258 widowers and 736 widows, or near three times the number. The total of males is 6697, of females 8016, hence there is 1319 or nearly a fifth majority of females: It may not be improper also to observe that the women, especially in the higher and middle ranks of society, are remarkably beautiful. These facts clearly prove that the manners and situation of Chester are peculiarly favourable to the female constitution.

Other observations may be deduced from these Tables, which confirm, correct, or illustrate various questions of importance to society. The number of married persons in Chester is 4881, of unmarried 9832, that is, nearly a third is married, which is a common proportion. Upwards of one half of the inhabitants above 15 years old are or have been married, the proportion being as 4 to 7. Though Chester is so uncommonly healthy, yet this, like most other great towns, is unfavourable to population. Thus it appears, from the general Bill for ten years, that, on an average, one marriage produces less than three children. One cause of this small proportion is probably the want of manufactures, which might enable the lowest class of people to marry in earlier youth. Taking the whole town, the number of persons in each family is 4 and 1-3rd. The inhabitants under 15 years old are 4486, that is, more than a third. The proportion of deaths this year to the number of inhabitants is nearly at 1 to 27: this difference from the common degree of health is occasioned by the unusual fatality of the small-pox. Table III shows that the greater mortality of the summer than the winter quarter of 1774 was occasioned by the epidemic small-pox, which began in July; yet still that winter and autumn taken together were more fatal than spring and summer in the proportion of 326 to 220, that is, near one sixth more died in the former than the latter portion of time.

There is a general prejudice in Chester, that it is unhealthy to inhabit the Rows; a prejudice most clearly refuted by many of the preceding observations. The Rows run along the central streets, which include incomparably the most healthy part of the town.

That the centre is the most healthy part of this city, that a less proportion die annually here than in most country villages, and, as far as observations have hitherto been made, that it is probably as healthy as any spot upon earth, are surprising facts: yet these facts are clearly evinced by the

united evidence of six separate districts taken on a medium of ten years. Some conjectures, supported by a few facts, are hazarded concerning the cause of unhealthiness in the suburbs. Future observations of a like kind in different situations, will confute or confirm these conjectures, which if true may be of great importance to society by discovering and avoiding the sources of disease. Towns divided and numbered in separate districts, compared with their respective registers, and illustrated with a description of every circumstance peculiar to each, that may be supposed to influence health, might, by a numerous induction of facts, lead to a certain investigation of the cause that renders towns so generally unhealthy. A diligent and sagacious attention to this subject might produce a discovery how to make towns as healthy as the country: a discovery of the most beneficial consequence in this age of elegant refinement which collects the greatest part of mankind into large towns.

TABLE I.

Deaths, Ages, and Conditions.

Ages.	Males.	Females.
Under 1 month	11	6
Between 1 and 2 months	9	8
„ 2 „ 3 „	4	1
„ 3 „ 6 „	9	5
„ 6 „ 9 „	16	10
„ 9 months & 1 yr.	7	19
„ 1 and 2 years ...	30	22
„ 2 „ 3 „ ...	19	26
„ 3 „ 4 „ ...	24	22
„ 4 „ 5 „ ...	7	9
„ 5 „ 10 „ ...	18	12
„ 10 „ 15 „ ...	1	4
„ 15 „ 20 „ ..	7	5
Total.....	162	149

Ages.	Batchel.	Husband.	Widowers.	Maids.	Wives.	Widows.	Total.
20-25	6	2	...	6	2	...	16
25-30	5	2	1	3	11	...	22
30-35	2	3	...	3	4	1	13
35-40	3	4	1	...	5	...	13
40-45	2	3	2	2	6	2	17
45-50	...	4	...	...	3	2	9
50-55	...	4	2	2	5	2	15
55-60	2	6	3	2	5	1	19
60-65	3	7	1	4	3	4	22
65-70	1	7	2	2	1	5	18
70-75	2	6	1	4	1	9	23
75-80	...	3	6	...	3	5	17
80	1	...	2	...	..	4	7
81	...	...	3	...	...	2	5
82	...	...	1	...	...	3	4
83	...	...	1	...	...	2	3
84	..	...	...	2	1	2	5
85	...	...	...	...	...	1	1
86	...	1	1	...	...	...	2
87	...	...	...	...	...	1	1
88	...	...	1	...	...	...	1
89	...	...	...	...	...	..	...
90	...	...	...	...	..	2	2
Total	27	52	28	30	50	48	235
							162
							149
					Total ..		546

TABLE II.

Diseases.

	Under 1 Year.	Betw. 1 & 2.	2–3.	3–5.	5–10.	10–15.	15–20.	20–30.	30–40.	40–50.	50–60.	60–70.	70–80.	80–90.	90–100.	Total.
I. Febrile Diseases:—																
Fever, (Gen. 5, 6)	1	1	...	...	5	...	3	11	3	3	4	4	...	...	...	35
Puerperal Fever (5)	...	...	...	...	...	...	...	3	1	...	...	...	...	...	...	4
Mortification (7)	...	...	...	...	1	...	...	...	...	1	1	3	...	...	...	6
Sore throat (10)	...	1	...	3	...	...	...	...	1	...	...	...	...	...	...	5
Inflam. of the Bowels (16)	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Gravel and Stone (19)	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1
Teething, (Sauv. 198)	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Rheumatism (22)	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Gout (23)	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1
Natural Small-pox (26)	51	38	42	49	22	...	...	...	...	...	...	...	...	...	...	202
Miliary Fever (29)	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	2
Consumption (35)	...	...	1	1	...	1	8	11	9	12	6	5	...	...	...	54
Hæmorrhage (puerp.) (37)	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
II. Nervous Diseases:—																
Apoplexy & sud. death (40?)	...	...	...	...	...	...	...	2	..	...	1	...	2	...	...	5
Palsy (41)	...	...	...	...	...	...	...	...	...	1	2	...	4	...	...	7
Indigestion (43)	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	2
Locked Jaw (46)	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
Convulsion (48, 50)	37	11	...	6	1	1	...	...	...	...	1	...	...	...	...	57
Asthma (52)	...	...	...	...	...	...	...	...	...	1	6	6	3	...	...	16
Colic (55)	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Insanity (63)	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1
III. Dis. of the Habit:—																
Weakness of Infancy (65)	13	...	2	1	0	1	...	...	...	...	...	...	...	...	...	17
Decay of Age (66)	...	...	...	...	...	...	...	...	...	...	2	14	25	29	2	72
Dropsy (71, 75)	...	...	...	...	1	...	...	1	5	1	5	1	...	...	...	14
Dropsy of the Brain (72)	...	...	...	...	...	1	...	...	..	...	...	...	...	...	...	1
Dropsy of the Chest (74)	...	...	...	...	..	...	..	...	...	..	1	...	...	...	...	1
Venereal Disease (81)	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Jaundice (87)	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	2
IV. Local Diseases:—																
Cancer (114)	...	...	...	...	...	...	..	...	...	...	1	1	...	...	...	2
Rupture (124)	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Inv. uterus, (puerp.) (125)	...	...	...	...	...	..	...	...	1	...	...	...	...	...	...	1
Fistula (128)	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
Ulcer (128)	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Unknown disease	...	...	...	1	...	...	...	1	2	5	...	2	4	...	...	15
Casualty	...	...	...	1	...	...	1	3	0	0	1	1	1	...	...	8
Total	105	52	45	62	30	5	12	38	26	26	34	40	40	29	2	546

TABLE V.

State of Population, Small-pox and Fevers in 1774.

Parishes.	Families.	Inhabitants.	Males.	Females.	Married.	Widowers.	Widows.	Under 15 Years old.	Above 70 Years old.	Recovered from Small-pox in 1774.	Dead of Small-pox in 1774.	Ill of Small-pox in Jan. 1775.	Not had Small-pox in Jan. 1775.	Recovered from Fever in 1774.	Dead of Fever in 1774.	Ill of Fever in Jan. 1875.
St. Oswald's	924	4027	1914	2113	1340	64	189	1302	143	321	40	5	350	58	2	1
„ John's	774	3187	1411	1776	1057	51	190	970	153	284	52	6	218	55	4	3
„ Mary's	583	2392	1097	1295	892	41	89	805	100	240	45	3	205	70	5	8
Trinity	330	1605	730	875	485	43	95	521	65	127	24	3	97	9	0	1
St. Peter's	193	920	414	506	267	8	28	221	43	52	6	0	39	15	1	3
„ Bridgett's	154	623	283	340	218	7	27	170	26	52	6	1	35	4	2	0
„ Martin's	154	611	280	331	230	12	30	164	30	47	18	0	35	9	3	5
„ Michael's	135	575	239	336	152	22	40	130	30	15	2	0	31	4	2	0
„ Olave's	134	536	246	290	194	4	37	185	21	42	8	1	43	22	9	3
Cathedral	47	237	83	154	46	6	11	18	14	3	1	0	7	1	0	0
Total.....	3428	14713	6697	8016	4881	258	736	4486	625	1183	202	19	1060	257	28	24

TABLE III.

Total of Deaths.			Deaths by Small-pox.		
Winter,	107	46	January	0	1...Winter.
		30	February	1	
		31	March	0	
Spring,	90	25	April	0	6...Spring.
		30	May	3	
		35	June	3	
Summer,	130	32	July	11	65...Summer.
		53	August	26	
		45	September	28	
Autumn,	219	69	October	46	130...Autumn.
		76	November	44	
		74	December	40	
Total...	546		Total...	202	

TABLE IV.

Deaths by the Small-pox under One Year old.

	Males.	Females.	Total.
Under 1 month	0	0	0
Between 1 and 2 months	1	1	2
„ 2 „ 3 „	1	0	1
„ 3 „ 6 „	2	2	4
„ 6 „ 9 „	12	10	22
„ 9 months and 1 year ...	6	16	22
Total ...	22	29	51

TABLE VI.

General Bill of the several Parishes for Ten Years, viz., from 1764 *to* 1773, *inclusively:*

	Chr.	Bur.	Mar.
St. Oswald's	949	1053	456
„ Mary's	820	795	294
„ John's	939	892	271
„ Peter's	246	149	75
Trinity	445	394	127
St. Olave's	173	96	29
„ Michael's	158	115	56
„ Bridget's	131	110	69
„ Martin's	101	103	50
Cathedral	8	24	0
Total ...	3970	3731	1427
General Bill for the Year 1774.	415	546	141

TABLE VII.

The Numbers that die annually in the several Parishes, taken upon an Average of Ten Years, viz., from the Year 1764 *to* 1773 *inclusively.*

St. Mary's	1 in 30	or 33.3 per 1000
„ Oswald's	1 in 36	or 27.7 „
„ John's	1 in 36	or 27.7 „
Trinity	1 in 41	or 24.3 „
St. Michael's	1 in 50	or 20 „
„ Olave's	1 in 55	or 18.1 „
„ Bridget's	1 in 56	or 17.8 „
„ Martin's	1 in 59	or 16.9 „
„ Peter's	1 in 61	or 16.3 „
Cathedral	1 in 87	or 11.4 „
The whole Town	1 in 40	or 25 „
The Parishes within the Walls, viz., Michael's, Olave's, Bridget's, Martin's, Peter's, and Cathedral.	1 in 58	or 17.2 „

C. E. P.

TABLE VIII.

The Proportionable Number of Inhabitants that die annually in the following Places.

Whites in Jamaica	1 in 5	or 200 per 1000
Vienna	1 in 19½	or 51.2 „
London	1 in 20¾	or 48.1 „
Edinburgh	1 in 20¾	or 48.07 „
Leeds	1 in 21⅝	or 46.2 „
Dublin	1 in 22	or 45.4 „
Rome	1 in 23	or 43.4 „
Amsterdam	1 in 24	or 41.6 „
Breslau	1 in 25	or 40 „
Berlin	1 in 26½	or 37.7 „
Northampton	1 in 26¾	or 37.7 „
Shrewsbury	1 in 26¾	or 37.7 „
Liverpool	1 in 27¾	or 36.3 „
Manchester	1 in 28	or 35.7 „
COUNTRY PARISHES.		
Pais de Vaud	1 in 45	or 22.2 „
Country Parishes in Brandenburgh ...	1 in 45	or 22.2 „
Others in Brandenburgh	1 in 50	or 20 „
A Country Parish in Hampshire for 90 Years	1 in 50	or 20 „
Island of Madeira	1 in 50	or 20 „
Stoke Dameral in Devonshire, one Year ...	1 in 54	or 18.5 „

C. E. P.

CHESTER: PRINTED BY J. MONK,

For the Benefit of the Parish Clerks who keep the Registers.

The Ordinary Meetings of the Society are held at

11, CHANDOS STREET, CAVENDISH SQUARE,

ON THE SECOND WEDNESDAY OF EACH MONTH FROM NOVEMBER TO JULY INCLUSIVE, UNLESS OTHERWISE ANNOUNCED.

THE CHAIR IS TAKEN AT EIGHT O'CLOCK P.M. PRECISELY.

Subscriptions may be paid to the Treasurer. The Annual Subscription of Ordinary Members is One Guinea.

Ordinary Members are entitled to all privileges of membership, and to receive a copy of all the Society's publications issued during the year for which their subscriptions are paid. But Ordinary Members, resident beyond the limits of the Metropolitan Postal District, and having paid one or more annual subscriptions, may, on expressing a wish to that effect, be distinguished as Non-Resident Members.

Non-Resident Members are not liable to further payment. They have the privilege of attending meetings, and are entitled to receive the publications of the Society issued during the year for which their subscription is paid; but they are not entitled to vote at meetings of the Society nor to hold office in it.

The Rules and Regulations of the Society, with an Exposition of its Objects, may be obtained from the Secretaries.

The Transactions for the Sessions 1859-60, 1866-67, *and* 1867-68 *are out of print. With these exceptions, those for the Sessions from* 1860-61 *to the last Session inclusive, may be obtained from the publisher,* Mr. DAVID BOGUE, 27, KING WILLIAM STREET, STRAND. *Prior to* 1859-60, *the Transactions were published in the* "SANITARY REVIEW." *The issue of a new series of the Transactions was begun in* 1882.

TRANSACTIONS

OF THE

EPIDEMIOLOGICAL SOCIETY OF LONDON.

VOL. I.

PART I. SESSION 1859-60. (*Out of Print.*)
PART II. SESSION 1860-61. (*Price 4s.*)
PART III. SESSION 1861-62. (*Price 4s.*)

VOL. II.

PART I. SESSIONS 1862-63 and 1863-64. (*Price 4s.*)
PART II. SESSIONS 1864-65 and 1865-66. (*Price 4s.*)

VOL. III.

PART I. SESSIONS 1866-67 and 1867-68. (*Out of print.*)
PART II. SESSIONS 1869-73. (*Price 5s.*)
PART III. SESSION 1874-1875. (*Price 5s.*)

VOL. IV.

PART I. SESSIONS 1875-76 and 1876-77. (*Price 5s.*)
PART II. SESSIONS 1877-78 and 1878-79. (*Price 5s.*)
PART III. SESSION 1879-80. (*Price 5s.*)
PART IV. SESSION 1880-81. (*Price 6s.*)

NEW SERIES.

VOL. I. SESSION 1881-82. (*Price 5s.*)
VOL. II. SESSION 1882-83. (*Price 5s.*)
VOL. III. SESSION 1883-84. (*Price 5s.*)

DAVID BOGUE, 27, KING WILLIAM STREET, STRAND.

2 Jul 3 5-2?